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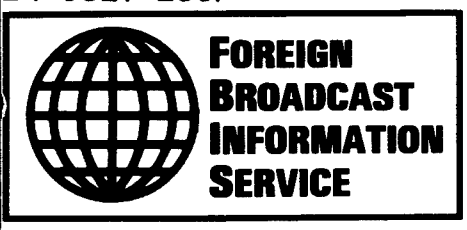

JPRS Report

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SCIENCE & TECHNOLOGY

CHINA

CONTENTS

APPLIED SCIENCES

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ANALYSIS OF MS-DOS OPERATING SYSTEM ON INTEL 86/310 MICROCOMPUTER

Chongqing WEIXING JISUANJI [MICROCOMPUTERS] in Chinese No 1, 14 Jan 87 pp 53-60

[Article by Zhang Yingdong [4545 2504 2639] and Qiu Baiguang [6726 4102 0342] of Department of Computer Science, Nanjing Aeronautical College]

[Abstract] The paper is a rigorous analysis of the configuration and functions of the MS-DOS operating system used on the Intel 86/310 microcomputer. Comparisons are made on portability of the NH-DOS operating system to the 86/330 and the 380, thus revealing the factor of compatibility with the IBM-PC system for MS-DOS in an 86/310 environment. For better performance of the 86/310 MS-DOS, several feasible routes of software compensation are proposed to fulfill the requirements on IBM-PC functions. Near the close of the investigation, a new magnetic disk operating system NH-DOSV85.4 was installed in an Intel 86/310 for simultaneous compatibility to IBM-PC and MS-DOS of Intel. The reason for its better system performance is pointed out.

Two tables list the BIOS functional comparison of the IBM-PC/XT and the Intel 86/310, and the drive function of equipment using the BIOS module. Eight figures show the DOS configuration of the IBM-PC and the 86/310, relationship between DOS module and two kinds of software, separate start of the system, distribution of internal memory after carrying out the compensation measure, procedure for obtaining the ASCII code from the scan code, procedure for processing keyboard signals, management procedure for screen enhancement, and the system (NH-DOS) flowchart.

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CSO: 4009/1095

256 CHANNEL A/D CONVERTER DESIGNED FOR APPLE MICROCOMPUTER

Chongqing WEIXING JISUANJI [MICROCOMPUTERS] in Chinese No 1, 14 Jan 87 pp 61-67

[Article by Zhang Yi [4545 5042], Nanchang Municipal Microcomputer Institute]

[Abstract] Among microcomputers used in China, the APPLE II is strongly represented; however, the A/D cards commercially available are generally for 8 or 16 channels. Thus, these cards cannot meet the requirements of real-time control and data processing systems. This article describes a 256 channel 8 bit A/D converter for direct connection with APPLE II series microcomputers for process control and data collection in industry or scientific research. The A/D converter is made up of five components; a control and decoding circuit, an A/D conversion circuit, a channel decoding latch circuit, a 256 channel simulation switch, a 256 channel analog switch, and a 16 channel counter switch.

Two tables list the values of the CD-4052, and numbers of column, sets and channels. Eight figures show the principle of the A/D converter system, configuration of ADC 0846 core chip, base pin numbers of the CD 4052 master chip, time relationship of column selection, time sequence in readout of conversion results, flowchart of 256 channel A/D conversion, a BASIC program on 256 channel A/D conversion, and its circuit diagram.

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OUTPUT PRINCIPLE OF CHINESE CHARACTERS FROM MICROCOMPUTER

Chongqing WEIXING JISUANJI [MICROCOMPUTERS] in Chinese No 1, 14 Jan 87 pp 68-74

[Article by Zhang Xiaomin [1728 2556 2404], Computer Station, Chengdu Military Region]

[Abstract] The output technique is quite important in computer systems for Chinese characters because Chinese character computers are inherently different from Western language computers in their output. Therefore, the article presents in detail the printout principle, design concept of drive program, operation flowchart, method of forming different types of Chinese characters, and related experience with design and use for database of 16 x 15 and 24 x 24 dot matrices. A figure shows the relationship between the graphic printout data and the printing points. Three other figures show a flowchart of the main program, a printout module, and a printout flowchart for Chinese characters.

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SYNTHETIC RUBBER TECHNOLOGY MEETING IN WUXI

Lanzhour HECHENG GONGYE XIANGJIAO in Chinese Jan 87 p 70

[Text] The synthetic rubber technology subcommittee of the national rubber standard committee held its annual meeting on 31 October, 1986 in Wuxi. Fifty seven representatives from 41 units participated in the meeting, including the Development Department and the Production Department of the Chinese Petrochemical General Company, the national rubber standard committee, universities, and research, production, and manufacture units.

The meeting was chaired by Zhu Junyao [2612 0689 1031], Chairman of the synthetic rubber technology subcommittee. In the meeting the participants studied the instructions of the national leaders and the speeches given by the Deputy Director Zhu Rongji [2612 6954 1015] of the State Economic Council in the working conference and summary conference on adapting international standards in China. Zhao Bonian [6392 2672 1628] of the secretariat in the synthetic rubber technology subcommittee made a report summarizing the 1986 effort of the subcommittee. Also reported in the meeting were mail survey results on China's special synthetic rubbers and calibration experiments of the Men-ni viscosimeter. Recommendations were solicited on the 1987-88 efforts on the standardization of synthetic rubber and latex.

After careful deliberation, the conference passed unanimously the national standard proposal on "Synthetic rubber and synthetic latex terminology" and the industry standard on "synthetic latex nomenclature and number code". Four working groups were established on the standardization of butadiene-styrene, maleic resin, chloroprene, and synthetic rubber and latex.

9698/12951
CSO: 4008/1057

TETRAPROPYLENE FLOURIDE PRODUCTS SAID TO RESIST HEAT, CORROSION

Lanzhou HECHENG XIANGJIAO GONGYE in Chinese Jan 87 p 72

[Text] Tetrapropylene fluoride rubber is a new elastomer formed in the copolymerization of tetrafluoride ethylene and propylene. Shanghai Rubber Products Research Institute has made pipes and sheets using this material and applications showed that these products resist heat and corrosion very well. Such products have wide uses and perform well in adverse environments where other types of rubber fail. The properties of tetrapropylene fluoride remain satisfactory even after long term (3500 hours) soaking in No. 10 engine oil or 95 percent engine oil plus 5 percent kerosene and then aged for 2085 hours at high temperature (120°C)

Tetrapropylene fluoride rubber is highly resistant to ammonia and acetic acid and can be used in enclosed high pressure containers in chemical fertilizer plants and under elevated temperatures. In addition, since it has good corrosion resistance, it may also be used in oilfields to replace butadiene-acrylonitrile rubber and Viton.

This type of rubber has superior resistance to high temperature steam and may be used in geothermal and deep oil well development, in thermal exchangers and in sealed steam sterilization of food and milk.

When tetrapropylene fluoride rubber is used in integrated circuits and components, it is in contact with highly corrosive media such as arsenic trihydride or germanium tetrahydride. Long term user experience has shown that there is no sign of softening and the seal remains reliable.

9698/12951
CSO: 4008/1057

FOUR-WAVE MIXING USED IN OPTICAL AMPLITUDE ENCODING

Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 7, No 1, Jan 87 pp 92-96

[Article by Guo Siji [6665 1570 0679] and Zeng Xiaodong [2582 1420 2639] of the Northwest Telecommunications Engineering Institute, Department of Technical Physics, Xian; received 13 November 1985; revised manuscript 27 March 1986]

[Text] Abstract: This paper discusses the viability of using transient four-wave mixing (TFWM) in optical amplitude modulated encoding. It gives an effective numerical method to solve coupled wave equations with discontinuous solutions and to study the effect of system parameters on signal quality. The results show that a four-wave mixing system can form a high-speed encoding converter and thereby provides a new means for ultra short pulse high-speed encoding.

Four-wave mixing (continuous pumping) is called stable four-wave mixing or transient four-wave mixing (TFWM), depending on whether the detected light is continuous or pulse. Because the phase conjugate properties of reflected light have compensation effects on wave-front distortion, stable four-wave mixing has very broad application prospects for spatial optical information processing. People have already done a large amount of theoretical and experimental work in this area with many useful results. At the same time it has also been noted that transient four-wave mixing also has many compelling potential applications in temporal optical signal processing. Some tentative ideas in this regard have been provided, such as: signal delay, correlation, and convolution operations, envelope inversion, space-time encoding [1], measurement and study of ultra short pulses [2], and logic operation elements in optical computers [3]. However, at present work in this area is still in the beginning stage.

This paper investigates the theoretical viability of applying transient four-wave mixing to optical amplitude modulation encoding and analytically studies the limitations of the system parameters to increase coding speed as well as the principles of the selection system parameters for increasing encoding quality. The results show that using a transient four-wave mixing system we can construct a high speed encoding converter capable of achieving temporal optical amplitude modulation encoding. This sort of system gives a high

coding speed transmission signal and provides a new means for high speed encoding of ultra short pulses. This has the possibility of making optical communication more completely develop the advantage of its large transmission capacity.

The paper also gives means to better resolve the computational method problems of solving for one class of hyperbolic type equation system discontinuous solutions. This is an effective computational method for study of non-uniform pumping transient four-wave mixing.

I. Basic Principles

Figure 1 is a schematic of one kind of transient four-wave mixing. E_1 and E_2 represent continuous pumped light propagating in the phase direction. E_1 and E_2 are nonuniformly distributed perpendicular to the direction of propagation. E_p represents a detector light pulse propagating perpendicular to the direction of pumping propagation. E_3 represents light propagated in the direction of the E_p reflection produced by nonlinear interaction which, for convenience, is called the signal light (or reflected light). According to nonlinear optical theory, the signal light, E_3, is related to E_1, E_2, and E_p. The relationship between them is determined by the third order nonlinear polarized intensity $P^{(3)}$ and Maxwell's equations. If the pumped light E_1 or E_2 is varied in a certain way according to human intent, then there must be a corresponding variation caused in the signal light E_3. By utilizing this property, we can construct a certain kind of temporal signal processing system.

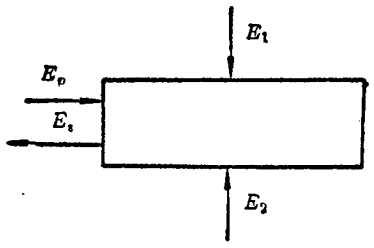

Figure 1. Transient Four-Wave Mixing (TFWM)

The structure of a transient four-wave mixing encoding system is as shown in Figure 2. First, amplitude modulation spatial encoding of pumped light E_1 is done. That is, the amplitude of E_1 in the z direction in space (the direction of propagation of E_p) is distributed according to a certain intent. E_2 can be reflected by a plane mirror with E_1 giving the corresponding 0, 1 encoding system shown in Figure 2. In the process of propagation of the detection light from the entry end of the dielectric to the other end, in places where the pumping is not zero the system will produce a signal light and where the pumping is zero, the system will not produce a signal light. Thus the variation over time of the amplitude envelope of the signal light will also be 0, 1 distributed, consequently carrying the information of the pumping light at various locations in the dielectric space. Furthermore, the spatial amplitude code will be converted into a temporal amplitude code.

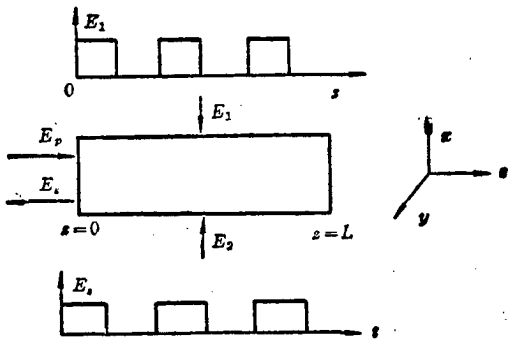

Figure 2. TFWM Encoding System

This paper discusses the problem in the framework of classical theory. Let four light fields be the same polarization and frequency in the same plane and the light field frequencies be far from the dielectric resonance zone. This way the electric field intensities can be expressed using scalars. Suppose the formulae for representing the electric field intensity of the four fields are

$$E_1(z,\ t)=\frac{1}{2}\,\varepsilon_1(z)\exp[i(\omega t+kx)]+C.C., \tag{1}$$

$$E_2(z,\ t)=\frac{1}{2}\,\varepsilon_2(z)\exp[i(\omega t-kx)]+C.C., \tag{2}$$

$$E_p(z,\ t)=\frac{1}{2}\,\varepsilon_p(z,\ t)\exp[i(\omega t-kx)]+C.C., \tag{3}$$

$$E_s(z,\ t)=\frac{1}{2}\,\varepsilon_s(z,\ t)\exp[i(\omega t+kx)]+C.C., \tag{4}$$

in which ε_1, ε_2, ε_3, ε_4 represent the complex amplitude of the 1,2 pumping light detection light and the signal light. In the approximation for pumping nonaxial space and slowly varying envelopes, substituting formulae (1)-(4) in Maxwell's equations, the coupling equations describing the transient four-wave mixing process can be derived

$$\frac{\partial\varepsilon_s}{\partial z}-\frac{1}{v}\frac{\partial\varepsilon_s}{\partial t}-\alpha\delta_s=iK\varepsilon_p^*, \tag{5}$$

$$\frac{\partial\varepsilon_p^*}{\partial z}+\frac{1}{v}\frac{\partial\varepsilon_p^*}{\partial t}+\alpha\varepsilon_p^*=iK\varepsilon_s, \tag{6}$$

in which, v is the speed of light in the dielectric, α is the damping factor describing the dielectric dissipation, $K=(3/2)\mu_0\varepsilon_0\chi^{(3)}\omega^2\varepsilon_1(z)\varepsilon_2(z)/k$ is a function of z, called the coupling coefficient, and the initial boundary conditions corresponding to formulae (5) and (6) are

$$\varepsilon_p(z,\ 0)=\varepsilon_s(z,\ 0)=0,\quad (0\leqslant z\leqslant L) \tag{7}$$

$$\varepsilon_p(0,\ t)=\varepsilon_p(t),\ \ \varepsilon_s(L,\ t)=0, \tag{8}$$

in which L is the length of the dielectric in the z direction. Equations (5)-(8) are the fundamental equations for the problems discussed in this paper.

II. Numerical Methods for the Coupling Equations

Under general conditions, there is no way to solve formulae (5) and (6) for analytical solutions so numerical methods must be used. In the problem discussed in this paper, the incident light amplitude envelope, $s_p(t)$ has jump discontinuities (like taking a δ function or a rectangular function), does not satisfy the initial conditions in formula (7), and K(z) also has jump discontinuities. These features make it so that the solutions of equations (5) and (6) exhibit discontinuities so general algorithms do not work. Precisely computing the discontinuous solutions of coupling equations (5) and (6) is the major difficulty in discussing this problem.

At present there are two methods for numerical computation of discontinuous solutions of hyperbolic equations. One is called the method of separation of singularities and the other is called the punch through method. For the nonhomogeneous pumping transient four-wave mixing problem, since prior understanding of the discontinuity's nature is not great and connecting conditions are not given, we can only use the punch through method. In order to overcome the disadvantage of the punch through method having rather large deviation at discontinuities, the authors adopted a nonviscous punch through difference equation to compute the numerical solutions of equations (5) and (6). This sort of algorithm was well suited to hyperbolic coupling equations of the form of formulae (5) and (6). Even under very bad conditions (K and s_p both having jump points), the solution is still fairly stable and there is sufficient precision. For the assumption of a nonaxial space, the problem of transient four-wave mixing process devolves to the solution of coupling equations of the following form

$$\frac{1}{v}\frac{\partial \phi}{\partial t}-\frac{\partial \phi}{\partial z}=f(z, t, \phi, \psi), \tag{9}$$

$$\frac{1}{v}\frac{\partial \psi}{\partial t}+\frac{\partial \psi}{\partial z}=g(z, t, \phi, \psi), \tag{10}$$

in which f and g are linear functions of ϕ and ψ. Suppose use of the difference equations below to approach equations (9) and (10),

$$\frac{\phi_m^{K+1}-\phi_m^K}{v\Delta t}-\frac{\phi_{m+1}^K-\phi_m^K}{\Delta z}=\frac{1}{2}(f_{m+1}^K+f_m^K), \tag{11}$$

$$\frac{\psi_m^{K+1}+\psi_m^K}{v\Delta t}+\frac{\psi_m^K-\psi_{m-1}^K}{\Delta z}=\frac{1}{2}(g_{m-1}^K+g_m^K), \tag{12}$$

in which the upper and lower indices represent the grid step numbers corresponding to the t and z directions respectively. (11) and (12) are different from general display difference equations. Their right sides are the average values of f at (K, m) and (K, m+1) and g at (K, m) and (K, m-1).

Actual computations show that this set of difference equations are reliable. Used in the punch through computation of discontinuous solutions they possess rather high precision. Their greatest advantage is that they do not produce smoothing effects for discontinuities which is something that the general punch through method cannot do.

III. The Effect of System Parameters on Encoding Performance

We take the spatial distribution of the pumping light, E_1 to be a 0, 1 code. When the width of the code elements is wider (relative to the incident light), they are represented by

$$\varepsilon_1(z) = E_{10} \sum_{n=0}^{3} \left[\text{step}\left(z - \frac{2nL}{7}\right) - \text{step}\left(z - \frac{2nL}{7} - \frac{L}{7}\right) \right], \tag{13}$$

and when the code elements are narrower, they are represented by

$$\varepsilon_1(z) = E_{10} \sum_{n=0}^{3} \left[\text{step}\left(z - \frac{nL}{4}\right) - \text{step}\left(z - \frac{nL}{7} - b\right) \right], \tag{14}$$

in which

$$\text{step}(x) = \begin{cases} 1, & (x \geqslant 0) \\ 0, & (x < 0) \end{cases}$$

The code width is b. In formula (13), b = (L/7) and in formula (14) b<(L/8). We respectively selected the amplitude envelope of the incident light to be Gaussian, rectangular, and δ function type and computed the signal wave of the system. Afterwards, A_0 was taken to denote the incident ray pulse width (temporal width X speed of light in the dielectric). For the Gaussian type, A_0 shows the width at amplitude (1/e).

1. Effect of Incident Pulse Width, A_0, on Encoding Performance

The effect of the incident pulse width, A_0, on encoding performance is very great. Since it limits the fundamental factors of coding speed it is a basic factor leading to distortion. When $A_0 \approx b$, the system's encoding performance is worst. Only for conditions of $A_0 << b$ or $b << A_0$, can reasonable good coding performance be achieved. When $A_0 << b$, the result according to computations is

$$\varepsilon_0(0, T) \approx \frac{i}{2} K\left(\frac{T}{2}\right), \tag{15}$$

that is, ε_3 is proportional to ε_1 (in which T = v·t). This sort of system is particularly well suited to transmitting images or occasions where we require the signal wave to reconstruct the pumping distribution. Since the signal wave is the result of the superposition of the signal light produced by the various parts of the incident pulse which is introduced into the interaction zone (places where the pumping is not zero), only after an entire pulse has entered the interaction zone does the maximum value of the signal wave appear. When the incident pulse is wider, this will make the signal wave form have

wider rising and falling edges. Therefore, the smaller A_0, the smaller the distortion. Figure 3 is the signal wave form for pumping being a 0, 1 distribution and conditions of A_0 when $A_0 << b$. It is evident, when A_0 is large, the distortion is larger. From formula (15) we know that the maximum distortion free encoding speed of this system is (v/2b).

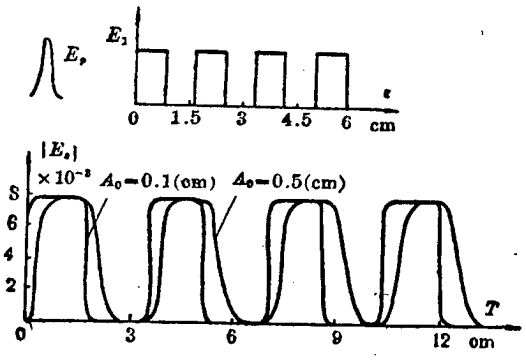

Figure 3. Reflected wave of TFWM encoding system for different A_0 with small K_0. $\varepsilon_{p_1} = 2.64$ ($A_0 = 0.1$ cm), $\varepsilon_{p_2} = 0.528$ ($A_0 = 0.5$ cm), $\alpha = 0$, $K_0 = 0.067$

For $A_0 >> b$, based on computational results we have (pumping taken as formula (14))

$$\varepsilon_s(0, T) \approx -\frac{i}{2} K_0 \sum_{n=0}^{3} \varepsilon_p^*\left(T - \frac{nL}{2}\right), \tag{16}$$

$K_0 = (3/2)\mu_0 c_0 \chi^{(3)} \omega^2 / k$, i.e., the amplitude envelope of the signal light reconstructs the amplitude envelope of the incident light. This type of system is able completely to develop the potential of the incident light pulse transmission code speed but is only suited to 0, 1 encoding because the signal light only carries the presence or absence of pumped light information. Figure 4 is the signal wave form of a system with $A_0 >> b$. From formula (16) we see that the signal light is a series of waves with an envelope of $(K_0/2)\varepsilon_p^*$ and a period of $2(L/4) = 2P$ ($P = L/4$ is the pumping element code period), so the coding speed is (1/2P). In order to make two neighboring code elements (signal waves) nonoverlaying, we must ensure the incident light width is smaller than the pumping code element period, i.e., $A_0 \leq P$. Therefore, the maximum distortion free coding speed of this system is about $v/2A_0$. For example, with a 10 ps pulse as detector light, i.e., $A_0 = 3 \times 10^{-3}$m, then the maximum coding speed of an $A_0 << b$ system is about 10 Gb/s (taking $A_0 = b/5$ as the distortion free standard) while the maximum coding rate of a $b << A_0$ system is about 50 Gb/s.

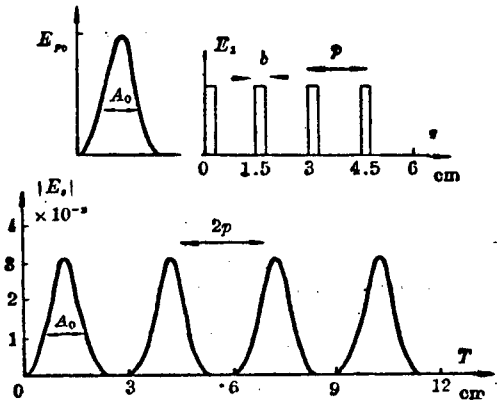

Figure 4. Reflected wave of TFWM system for b << A_0. A_0 = 1.0 cm, E_{p_ϕ} = 5.0, b = 0.1 cm, α = 0, K_0 = 0.067

2. Effect of the System Coupling Coefficient, K_0 on Encoding Performance

The system coupling coefficient, K_0, also has a large influence on encoding performance and is one of the basic factors leading to distortion. Because the photon momentum of the entire system must be conserved, at the same time that one signal photon is produced, the incident wave must be increased by one photon (obviously these two photons come from the pumping). Therefore, the amplitude of the incident light pulse during the process of transmission in the dielectric will be steadily increased. But the signal light is in direct proportion with the incident light magnitude and the coupling coefficient, K_0, so the signal light amplitude also increases steadily. When K_0 is larger, the coupling action is stronger and the incident light amplitude increases more quickly causing the signal light amplitude increase also to increase more rapidly. Strictly speaking, the signal wave amplitude increases monotonically with time (regardless of the dielectric losses), but when K_0 is very small, this sort of increase is too slow to the point that the variation produced within 2L/v is small enough to be ignored. Therefore, the smaller K_0, the smaller the distortion of signal wave code elements. Figure 5 is situation of code element distortion due to K_0 being too large. In order to improve the encoding quality, a K_0 should be taken smaller, but K_0 cannot be taken too small, otherwise the nonlinear interaction is too small and the signal wave is not observable experimentally.

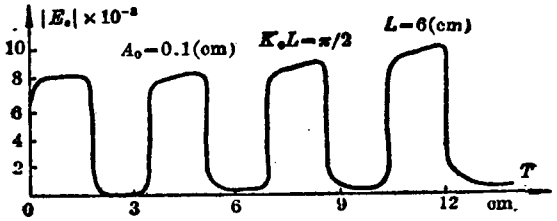

Figure 5. Distorted code for K_0 too large E_{p_ϕ} = 0.66, α = 0

3. Effect of Dielectric Dissipation on Encoding Performance

Dielectric dissipation is not good for encoding performance, leading to increases and decreases in the signal light amplitude over time, i.e., causing code element distortion. Consequently, material with a small dissipation should be selected to serve as the nonlinear dielectric.

IV. Conclusion

A transient four-wave mixing system can act as an encoding converter system. When the incident pulse width is smaller than the pumping code element width and the coupling coefficient, K_0, is relatively small, then the reflected light amplitude envelope is in direct proportion to the pumping amplitude envelope which varies spatially. Conversely, if the incident pulse width is far greater than the pumping code element width, then the pumping code element is equal to a series of switches and can control the presence or absence of the reflected signal. These two points are the fundamental basis for application of transient four-wave mixing to optical amplitude encoding. This sort of system has a very broad band width, is capable of obtaining modulated signals of high code speed, and provides effective means for ultra short pulse high speed encoding. At the same time we also want to point out that using transient four-wave mixing can very easily achieve conversion of images to temporal optical signals which, compared to the usual methods, simplifies scanning methods.

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He-Ne LASER WITH RECTANGULAR CROSS-SECTION DISCHARGE TUBE

Shanghai YINGYONG JIGUANG [APPLIED LASER] in Chinese Vol 7, No 1, Feb 87 pp 9-10

[Article by Ling Yiming [0407 0001 7686], Qian Meizhen [6929 2734 3791] and Liu Peng [0491 7720] of Nanjing Engineering College]

[Abstract] Design principles and preliminary experimental results for a helium-neon laser, with a rectangular cross-section discharge tube are presented. Since there are two lateral dimensional parameters (the long side and the short side) in a rectangular cross-section, the electron temperature in this discharge tube type is mainly determined by the short-side length. Thus, the mode volume can be made larger by increasing the long-side length. This discharge cross-section favors the relaxation of the lower energy level. Therefore, greater power output is attainable by using this shpae of rectangular cross-section. High laser output is realizable with a short discharge length wien using lasers on the stage or in hospitals. Four figures show a He-Ne laser with a rectangular cross-section of the internal cavity type, laser output power at several gas pressures and discharge currents, and the lateral direction distribution of laser beam light intensity.

PULSED XeCl EXCIMER LASER WITH GRAPHITE ELECTRODES

Shanghai YINGYONG JIGUANG [APPLIES LASER] in Chinese Vol 7, No 1, Feb 87 pp 17-20

[Article by Huo Yunsheng [7202 5366 3932], Lou Qihong [2869 4388 3163], Ding Aizhen [0002 1947 5271] and Chen Ruhui [7115 0320 6540] of Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Abstract] The output characteristics for a static XeCl laser with discrete graphite electrodes were studied. The average laser output power was found to increase with the pulse-repetition frequency up to 20 Hz because of the ballasting effects of the graphite electrodes on discharges. Five figures show the experimental apparatus; synchronous waveforms of output current, main output voltage, and laser pulse; laser output power versus gas pressure in laser chamber, and versus output voltage; and mean laser power versus pulse-repetition frequency.

SCREENING RULE AND RELIABILITY TEST FOR LONG-LIFETIME GaAlAs/GaAs DH LASER

Shanghai YINGYONG JIGUANG [APPLIED LASER] in Chinese Vol 7, No 1, Feb 87 pp 21-23

[Article by Chen Xinzhi [7115 2450 0037], Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Abstract] From an analysis of the homogeneous degeneration mode for semiconductor lasers, the author and his colleagues proposed a screening rule and carried out reliability tests. This method can serve in predicting device lifetime and estimating the effect of device characteristics on its lifetime. About 85 percent of the devices screened by the rule lasted more than 10,000 hours in normal operation. The average degeneration rate is 1.6 percent per 1,000 hours, and the mean square deviation is 1.0.

One table lists equipment parameters used in computation. Five figures show the threshold current value, attenuation rate, and junction temperature versus time; norm of screening program; and statistical distribution of attenuation rate. The paper was received for publication on 2 May 1986.

A PRACTICAL TWO-CHANNEL EXCIMER LASER

Shanghai YINGYONG JIGUANG [APPLIED LASER] in Chinese Vol 7, No 1, Feb 87 pp 38, 8

[Article by Zhao Zhensheng [6392 7201 5116], Hu Xuejin [5170 7185 6855], Cao Hongru [2580 3163 1172], Chen Yongrong [7115 3057 2837], Che Mingyu [6508 2494 3842], Li Zhaolin [2621 2507 5259] and Yin Baolong [3009 1405 7893] of Anhui Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Abstract] Excimer laser properties can be improved mainly as follows: 1. Higher laser output power is attainable by raising the pumping power, expanding the excited volume of laser, and increasing the operating gas pressure of the laser medium. However, these measures will introduce difficulties in stabilizing the coherent output and improving laser beam and spectrum quality. 2. Use of an oscillation--amplification system can effectively raise the output power density and enhance the laser beam and spectrum qualities. However, the key technical problem in the system is synchronous operation if two sets of single-channel equipment are used: one each for oscillation and for amplifification. Then one set of a two-channel excimer laser can realize oscillation--amplification in the nanosecond level and locked-in mode; in this arrangement, the structure is simple and experimentally convenient. The two-channel excimer laser can simultaneously output two laser beams at the same or different wavelengths; by changing the cavity sheets, it is feasible to output a laser at an infrared wavelength, such as a CO_2 or CO laser. Moreover, the two-channel laser can extend the pulse duration, thus adapting it to laser chemistry, laser deposition, and microelectronics processing. The paper presents the structure and operation features of the two-channel laser. One figure shows a layout diagram of the above-mentioned laser.

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UO_2 CERAMIC PLATE-TYPE FUEL ELEMENT

Chengdu HEDONGLI GONGCHENG [NUCLEAR POWER ENGINEERING] in Chinese Vol 8, No 1, 10 Feb 87 pp 74-78, 88

[Article by Zou Congpei [6760 1783 3099] and Dai Shouhui [2071 0649 1920]]

[Text] Abstract: This paper describes some applications of UO_2 ceramic plate-type fuel element in research and test reactor, naval reactor, small reactor for nuclear power, and summarizes the fabrication process of this plate-type fuel element.

I. Introduction

Because of its high melting point, chemical stability, compatibility with cladding materials and dimensional stability under irradiation, UO_2 has become the main fuel for power reactors.

Plate-type fuel elements are superior to rod-type fuel elements because plate elements run at a lower temperature and therefore improve the safety of the fuel elements. The plate elements also have a greater area for heat dissipation, a higher specific power in their active area and a greater stiffness than rod elements.

Extensive research has been done on plate elements and recent progress has been made in the fabrication technology of ceramic plate elements. UO_2 plate-type fuel elements will be used more and more.

II. Applications

1. Lowering the Fuel Concentration in Research Reactors

The main requirements of a research reactor are operation safety, reliability, experimental convenience, high neutron flux, and low cost. Earlier models of research reactors were mostly high-power natural uranium heavy water reactors. Later, emphasis was placed on safety, practicality, versatility, and a high neutron flux. To increase the neutron flux, the content of ^{235}U must be increased. There are two ways to do this, either increasing the fuel enrichment or increasing the uranium content in the fuel. Before the mid-1970's difficulties were encountered in increasing the uranium content in the fuel

but enriched uranium became available. As a result, high neutron flux reactors have always been light water reactors with highly concentrated uranium fuel.

Most research reactors use plate-type or multiple tube-type fuel elements to increase the area for heat dissipation and specific power.

In the history of research reactor development, three types of fuel elements have been used: alloy type, dispersion type, and ceramic type.

U-Al fuel elements were first used in MTR reactors and are still used today. Considerable fabrication and application experience has been accumulated on this type of fuel. The fuel core contains 18.8 to 25 percent of uranium, the corresponding uranium density is 0.61 to 0.86 g/cm^3, and the burnup is 25 to 30 percent. The Soviet MIR reactors use U-Al fuel at a burnup rate of 35 percent. Although U-Al alloy fuels have been successfully used in MTR and ETR reactors and many other types of research reactors for many years, this type of fuel has a low uranium concentration and the swelling under irradiation limited further increase in the burnup. Also, it is difficult to add burnable poisons uniformly in the reactor core. These shortcomings prevented its applications in high-flux, high-power reactors (such as ATR).

Dispersion-type fuel elements are used in ATR, MTR, ETR, and other research reactors.[1] The average burnup of the UAl_x-Al diffusion fuel used in the French Grenoble high-flux reactor that became critical in 1971 is 30 percent. The maximum burnup in this reactor is 60 percent, the power is 60 MW, and the average thermal neutron flux is 1.5×10^{15} $n/cm^2 \cdot s$.

U_3O_8-Al dispersion type of fuel elements are used in the U.S. EFIR reactor. The burnup is 20 percent, the power is 100 MW, and the average neutron flux is 5×10^{15} $n/cm^2 \cdot s$.

The two dispersion-type fuels have higher uranium content than the alloy type, generally 1.6 g/cm^3. Since both alloy fuel and dispersion fuel are limited by the type of fuel and the fabrication technology, their uranium contents are low. In order to increase the neutron flux, fuels with a high uranium concentration must be used.

In the United States there has been a widespread effort to lower the uranium concentration of research reactors and the U.S. Department of Energy has issued a plan called RERTR.[2] In countries other than the United States and the Soviet Union, there are limited capabilities for producing highly enriched uranium and the cost for purchasing it is high; these countries have a greater need to lower the uranium concentration of research reactors. Institutes in France, West Germany, Japan, and Canada have also joined the effort.

After the implementation of the RERTR project, all the research reactors that use highly enriched uranium will use low enriched uranium and the uranium density of the fuel will be increased from 0.6-1.6 g/cm^3 to 8.0 g/cm^3. Table 1 lists the uranium content of research reactors and Table 2 lists the possibility of lowering the uranium concentration.

Table 1. Uranium Content of Research Reactors

	Present		Near term		Long term	
	Vol %	g/cm^3	Vol %	g/cm^3	Vol %	g/cm^3
UAl_x-Al plate	~33	1.6	46-52	2.2-2.5	52-59	2.5-2.8
U_3O_8-Al plate	~25	1.7	36-43	2.5-3.0	43-50	3.0-3.4
U_3Si-Al plate	-	-	30-42	4.2-6.0	50-56	7.0-8.0
U-ZrHx rod	~4	0.75	~20	3.7	-	-

Table 2. Possibility for Lowering the Fuel Concentration in Research Reactors

	Present/near term/long term minimum enrichment, %		
	LPR	HPR	SHPR
U-Al alloy plate	<20	70/45/45	93
UAl_x-Al plate	<20	45/20/20	93/45/45
U_3O_8-Al plate	<20	45/20/20	93/45/45
UO_2 ceramic plate	<20	<20	<20
U_3Si-Al plate	<20	93/20/20	93/45/20
U_3Si plate	<20	93/93/20	93/93/20
U-ZrHx rod	<20	<20	-

The tables show that the uranium densities of UAl_x-Al and U_3O_8-Al plates are lower than that of U_3Si-Al plates and UO_2 ceramic plates. Considering the difficulties in fabrication, the highest uranium densities of UAl_x-Al and U_3O_8-Al plates can only be 2.5-2.8 g/cm^3 and 3.0-3.4 g/cm^3 respectively. Therefore, the fuel concentration of super high-power research reactors cannot be lowered to below 20 percent using these two types of fuel.

Extensive studies have been made on the fabrication of high uranium content U_3Si-Al, UAl_x-Al, and U_3O_8-Al plates and U-ZrHx rods[3,4] and irradiation samples have been made. Table 3 shows the core parameters. Before this, fabrication and irradiation experiments have also been done in the United States.[5]

Based on the above, the uranium content of U_3Si-Al plates and UO_2 ceramic plates are relatively high, the water corrosion resistance and radiation damage resistance of UO_2 are better than those of U_3Si, and considerable experience has been accumulated on the fabrication and application of UO_2. Therefore, it is more practical to use UO_2 ceramic plates as research reactor fuels.

2. Prolonging the Life of the Active Zone of Naval Reactors

The fuel consumption and the associated cost can be reduced by increasing the burnup depth and the life of the active zone. Furthermore, since changing fuel is a time-consuming and complicated task, a longer fuel change cycle and fewer fuel changes, or even no fuel change, will be economically and militarily very significant. To achieve this, we must develop new types of high uranium content fuels.

Table 3. Core Parameters of Research Reactor Fuel

Contractor	Fuel	Core dia. or thickness mm	Cladding mm	Fuel volume %	U-content g/cm^3
Argonne Nat. Lab.	U_3Si-Al plate	0.508	0.381	30	4.2
				40	5.6
Idaho Nat. Lab.	UAl_x-Al plate	0.635	0.318	42	2.0
		0.762		48	2.4
		0.889	0.381	52	2.6
Oak Ridge Nat. Lab.	U_3O_8-Al plate	0.508	0.254	10	0.7
		0.635	0.318	35	2.4
		0.762	0.381	39	2.7
		0.889	0.445	45	3.0
			0.508		
General Atomics	U-ZrHx rod			7	1.3
		12.9	0.381	11	2.2
				20	3.7

Zr-U alloy fuels are used in early U.S. naval vessels. The fuel enrichment is 40 percent, the burnup is 1 percent, the energy content is about 10,000 MW·d/t and the active zone may be operated at full power for 3,000 hours. Since the alloy only contains a small amount of uranium, highly enriched fuels are needed for the desired reactor lifetime, this is not good in terms of lowering the fuel costs.

It was reported that the long lifetime fuel elements in U.S. submarines are Zr-2-UO_2(+ZrO_2+Nb) cermet plates. This type of fuel increased submarine reactor lifetime from the previous 2-4 years to 10-20 years and the range was increased to 400,000 to 1 million nautical miles. Using conventional diffusion fabrication technology for fuel elements, the volume fraction of uranium is 31 percent and the uranium content is about 49 percent, the uranium density is about 3.0 g/cm^3. To increase the specific power and to prolong the lifetime of the active zone, highly enriched UO_2 must be used in the dispersion process. For countries with limited production capability for highly enriched uranium, it is difficult to use dispersion type fuel.

Since 1971, France has put into service five nuclear-powered submarines. The reactors in the first three used 90 percent concentration of Zr-U alloy plate-type fuel elements with a service cycle of 3.4a. The fourth used ceramic plate fuel elements with a concentration of only 3 percent but the service cycle is as high as 15a.

The CAS-230 reactor used in the French submarines is a semi-unitized pressurized-water reactor with a power of 230 MW and has two steam turbines. The propulsion power is 47.8 MW. The CAS-230 reactor uses plate-type fuel elements measuring 2000x100x5mm, 17 plates form a group and the dividing

plates are welded together on the side. Two of these fuel element assemblies are sealed in a zirconium box.

The plates are made of zirconium and each plate contains a number of small compartments. Each compartment contains two rectangular fuel elements of sintered UO_2. The enrichment is only 3-8 percent and the dimensions are 20x20x4mm. All the compartments are individually sealed and the cladding and separation strips are all made of zirconium.

Plate-type fuel elements in the CAS-230 reactor have the following advantages[6]:

(1) The temperature of the plate fuel is much lower than the rod fuel. When the CAS-230 reactor is operated at the rated power, the fuel temperature is 400°C.

(2) The safety of the plate fuel is good, especially when the cladding suffers damage. Since the fuel assemblies are separated from each other, the fission products can only escape from the damaged small compartment (1.6 cm^3). Since very little fission products will be released, the radiation products in the coolant will be kept low.

(3) The amount of heat stored in the fuel assembly during operation is low. In case of accidents, the highest temperature of the cladding is kept below 600°C and the cladding will seldom be damaged.

(4) The fuel temperature changes very little when the output power changes. The thermal expansion difference between the fuel and the cladding is small so the thermal stress is small when the output power changes.

(5) The cross-section of the plate fuel element is about 5 times of that of rod fuel element. The compartmentalized structure of the plate fuel assembly lends rigidity to the plate. The stiffness of just one plate is greater than that of a rod fuel, so the stiffness of 17 fuel plates welded together is even greater.

3. Application in Small Reactors

Small reactors for urban heating use are planned by France. These small reactors are also known as "thermos bottle" reactors. Since the fuel temperature is very low, this type of reactors are safe to operate and suitable for city use. Using the thermos bottle reactors, 4 million tons of petroleum can be saved in 1 year. The highest water temperature is 130°C, the power rating is 100 MW, and the fuel is 3 tons of low-enriched uranium. If this reactor is used for desalination of sea water, it can produce 40,000 m^3 of drinkable water per day. The small reactor uses 3.5 percent enriched UO_2 plate fuel elements,[7] similar to the fuel elements used in submarine reactors.

III. Fabrication Technology

As described above, the UO_2 plate fuel elements have distinct advantages in fuel recycle costs, operation lifetime, and particularly in reactor safety.

In the mid-1970's, France announced that the reactor in its fourth nuclear ship will use UO_2 ceramic plate fuel elements and filed a patent disclosure of a novel and safe fuel assembly and a simple fabrication technique. In 1977, the technology was declassified and transferred to the United States.[8] The new technique uses pneumatic pressure joining and does not require expensive machining of the plates. The UO_2 material is first cold-pressed and sintered to form plate-like cores measuring 20x20x4mm, and then coated with graphite or chromium using vapor deposition. They are then wrapped in 0.05-0.1mm thick zirconium foils like wrapping candies (see Figure 1), or, a spot welding method (Figure 2) is used to wrap the four edges of the core with 0.3mm thick zirconium alloy ribbon, as shown in Figures 3a and 3b. The wrapped UO_2 plates are lined up on a 0.4mm thick zirconium alloy lower cover plate (Figure 4), or, zirconium alloy strips of the same thickness as the fuel plates can be inserted between the fuel plates in either the vertical direction (Figure 5) or the parallel direction (Figure 6). The assembly is then framed in 4mm thick zirconium strips and covered by a 0.4mm thick zirconium alloy upper cover plate and spot welded in place. A single fuel plate is obtained after 4 hours of diffusion at 830°C and 1,000 bar helium pressure. Single fuel plates are then put together using zirconium rib welding.

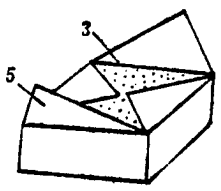

Figure 1. Core wrapped in zirconium foil

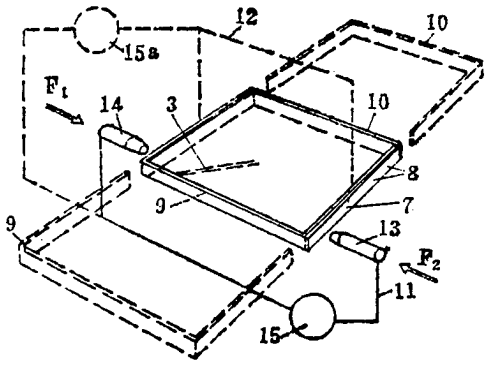

Figure 2. Spot-welding of fuel core wrapped in U-shaped Zr strips

[Legend on following page]

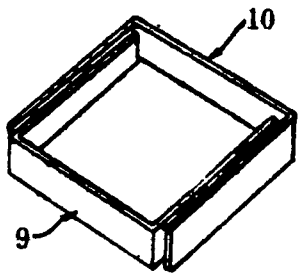

Figure 3a. First method of U-shaped wrapping

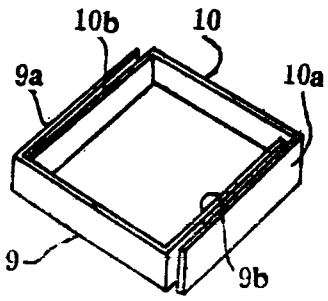

Figure 3b. Second method of U-shaped wrapping

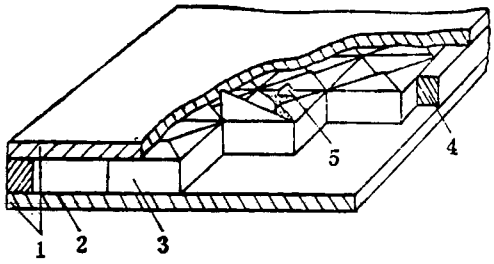

Figure 4. First fuel packaging method

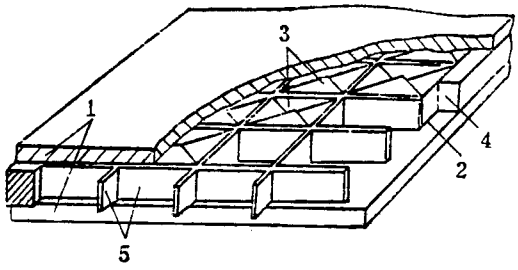

Figure 5. Second fuel packaging method

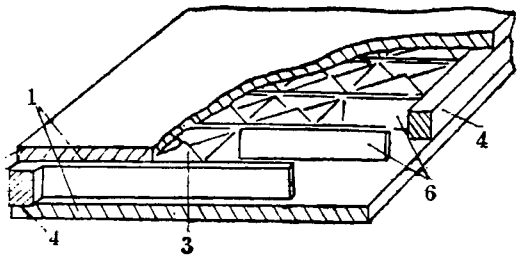

Figure 6. Third fuel packaging method with separating strips

Legend for Figures 1-6:

1,2 -- Upper and lower cover plates
3 -- Fuel core with zirconium foil wrapping
4 -- Frame strips
5 -- Zirconium foil
6 -- Separating strips
7 -- Protecting belt
8 -- Weld spots on protecting belt
9,10 -- U-shaped wrapping belts
11,12 -- Welding circuit
13,14 -- Electrodes
15,15a-- Electrodes

IV. Conclusion

Low enrichment UO_2 ceramic plate-type fuel elements have been successfully used in French nuclear submarines. They replaced the previous high enrichment Zr-U alloy fuels and increased the lifetime of the reactor active zone. This type of fuel may very well work in research reactors. The French small power reactors are already using UO_2 plate fuel elements.

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DESIGN FOR IMPROVING CONSTRUCTION OF LPR

Chengdu HEDONGLI GONGCHENG [NUCLEAR POWER ENGINEERING] in Chinese Vol 8, No 1, 10 Feb 87 pp 79-86

[Article by Shi Jingxian [2168 2529 6343]]

[Text] Abstract: This paper summarily deals with the technical problems in the design for improving the construction of LPR and the devices in production and research of LPR.

I. Introduction

Low power reactor (LPR) is an auxiliary facility of the high-flux engineering test reactor (HFETR). It is a swimming pool type reactor and uses the fuel elements unloaded from the HFETR. The original goal for building the LPR is to do physical testing of the burnup condition of the HFETR.

The designed power of the LPR is 100 kW and the cooling of the reactor core relies on natural convection. The heat content of the pool is carried out by a small cooling system and the reactor may operate briefly at 1,000 kW.

Based on the original design, the reactor building and the swimming pool have been built. Already installed are reactor core hold-down fixtures, control rod transmission mechanisms, cooling systems, power supply system, ventilation system, reactor hall hoist, is low, no dosage monitoring system, fuel element damage detection system, purification system, irradiation system, or production facilities were installed. The cooling system and the electrical system can only be operated at the rated power of 100 kW.

The purposes for modifying the LPR are as follows: To retain the function of burnup research for the HFETR, but increase the cooling capability of the LPR to reach a rated power of 5,000 kW to serve such applications as neutron doping of single crystal silicon, M_0-T_C "cow" production, neutron activation analysis, and γ loop.

The guiding principles for revising and operating the LPR are: 1) Whenever possible, use existing facilities and take advantage of the experimental data of the HFETR. Spend as little money as possible, make as little changes as possible and start operation at an earlier date to create wealth for the

society. 2) The overall design and the design of the various systems should stress safety, reliability, and practicality; do not overly stress sophistication.

II. Design for Modifying the LPR

1. Physical Design Calculation

The LPR uses fuel elements that had gone through two or three runs in the HFETR. These fuel elements unloaded from the HFETR have about 40 percent burnup. The LPR uses the same reflector material and control rods as the HFETR and the grid layout is similar to that of the first burner of the HFETR.

(1) Loading Plan

A ϕ63 channel is installed at the K_{II} position of the activated zone of the LPR for producing M_0-T_c isotopes. The K_{II} position is surrounded by three layers of fuel elements unloaded from the HFETR. Further out are two layers of beryllium blocks to form a hexagon. Six ϕ90 channels are laid at the six corners of the beryllium reflector and eight ϕ63 channels are located outside the six side walls for irradiation of single crystal silicon. Outside the beryllium reflection layer is an aluminum reflection layer. There are 10 control rods in the active zone. The automatic absorber rod is made of stainless steel but all other absorber rods are made of Ag-In-Cd. The layout is shown in Figure 1.

(2) Physical Calculation Method and Parameters

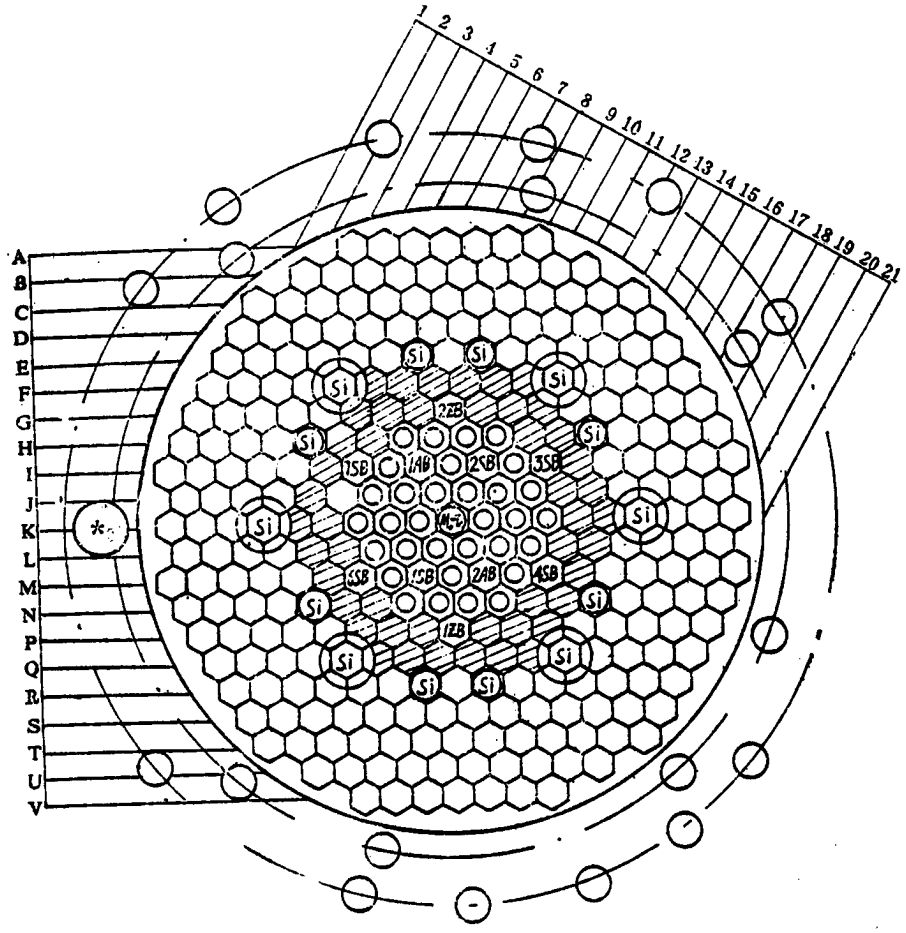
Physical calculation of the LPR also uses the two-dimensional, two group diffusion and burnup computation routine of the HFETR. Parameters of the unloaded fuel elements are taken from the HFETR burnup calculation results. ^{135}I and ^{135}Xe of the unloaded fuel had all decayed and the nuclear density is zero. The nuclear density of ^{149}Sm and ^{149}Pm depends on the service history and location of the fuel elements in the reactor, special considerations are required.

(3) Burnup Calculation Results[2]

The average burnup of the fuel loaded into the LPR is 40 percent, the designed burnup rate of the unloaded fuel is 45 percent. The integrated operating power is about 340 MW·d. Based on the rated power of 5,000 kW, the operation lifetime is 68 days.

(4) Reactivity and Rod Efficiency

With all the safety rods at the top and the remaining rods at the bottom, the thermal coefficient K_{eff} is computed to be 0.9223. After corrections for rod network, K_{eff} = 0.9297. Hot state subcriticality is -10β, cold state subcriticality is -8β, and the cold shutdown depth is -20β. The hot state rods-up K_{eff} is 1.084, the reserve activity is 11.8β, and the total efficiency[2] of the six manual rods and two automatic rods is 21β.



Legend:
- Fuel elements, 32 boxes
- ϕ63 silicon single crystal irradiation tube
- M_0-T_c isotope generator irradiation tube
- Beryllium blocks, 48 boxes
- Aluminum blocks
- Automatic rods
- ϕ90 silicon single crystal irradiation tube
- Safety rods
- Manual rods
- Slanted channel

Figure 1. Loading Layout of the LPR

(5) Neutron Flux Distribution[2] (See Table 1)

(6) Specific Emission of M_0-T_c Isotopes

Based on the neutron flux in Table 1, the specific emission may reach 1.2-1.5Ci/g. After three halflives ($T_{1/2}$ = 66.02 hr) or 8 days of irradiation, the specific emission is still 1Ci/g.

Table 1. Neutron Flux Distribution in LPR[2]

No.	Item	Data
1	Ave. fast n flux at active zone, $n/cm^2 \cdot s$	$(0.81\sim0.83)\times10^{14}$
2	Ave. thermal n flux at active zone, $n/cm^2 \cdot s$	$(0.29\sim0.32)\times10^{14}$
3	Fast n flux in K_{II} irradiation channel, $n/cm^2 \cdot s$	$(1.05\sim1.04)\times10^{14}$
4	Thermal n flux in K_{II} irrad. channel, $n/cm^2 \cdot s$	$(0.53\sim0.56)\times10^{14}$
5	Ave. thermal n flux in ϕ90 channel, $n/cm \cdot s$	$(0.62\sim0.66)\times10^{13}$
	Ave. thermal n flux in ϕ63 channel, $n/cm \cdot s$	$(0.83\sim0.86)\times10^{13}$

2. Thermodynamic Design Calculation[3,4]

The criterion for the thermodynamic design of the LPR is that, under normal operation, the surface wall temperature of the fuel elements must be lower than the boiling point and, in accidents, localized boiling of the fuel element surface is allowed but burnout is not permitted. Under all operating conditions the integrity of fuel elements must be maintained.

Based on HFETR calculation results, the wall temperature of the fuel elements in the LPR is estimated to be no more than 80°C.

A maze-like structure is used to solve the flow distribution problem in the holes of the grid plate.

The thermodynamic power and reduced power are listed in Table 2.

Based on the calculated results and the experience in operating the HFETR, the accident cooling system is eliminated. This not only saves investments but also simplifies the operating procedures.

3. Modified Construction of the Reactor and the Reactor Building

The entire reactor body of the LPR is placed in a swimming pool 8.5 m long, 2.2 m wide, and 8.93 m deep. Since the design power was raised, the operating conditions changed and appropriate modifications are needed to meet the physical, thermodynamic, and shielding requirements. The main additions are: 1) inner and outer cylinders, also serving as thermal shields, 2) fracture detection tubes and support, and 3) water outlet tube and lower support barrel. The entire reactor core sits on the bottom of the pool and supported by the grill plate and the upper and lower support barrels. The lower support barrel is connected to the main outlet pipe; the water suction inlet is located at the center bottom of the lower support barrel for uniform distribution of the flow through the core.

Table 2. Thermodynamic and Hydrodynamic Parameters of LPR

Item	At nominal power	At reduced power
Power, kW	5000	3500
Flow rate, t/h	620 (two pumps)	410 (single pump)
Inlet water temperature, °C	40	40
Outlet water temperature, °C	47	47.3
Ave. fuel box power, kW	131.7	92.19
Ave. thermal load of fuel element, $J/m^2 \cdot h$	3.4×10^8	2.39×10^8
Box power, kW	158.5	110.95
Max. box thermal load, J/m·h	5.6×10^8	3.9×10^8
Outlet water temperature of box, °C	56.2	57.1
Ave. flow speed in box, m/s	1.5	1
Pressure drop in box, kg/cm^2	0.14	Negligible

Fixed on the support plate, the middle section takes its position from the grid opening and the surrounding elements or beryllium blocks, and the upper half is suspended in the water, as shown in Figure 2. At the outlet of the elements a stainless steel damage detector tubes are installed and threaded out through the support structure to detect damage to fuel elements.[5]

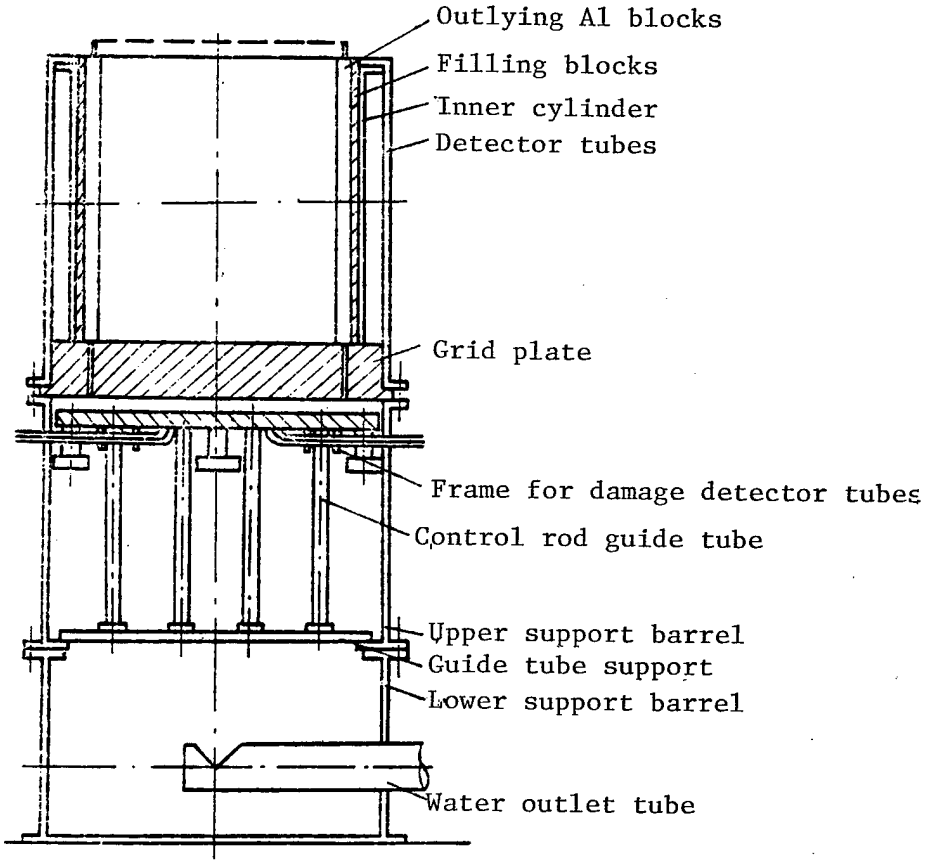


Figure 2. Reactor Body Construction

The 15t/3t bridge hoist is the main tool for moving the structures in the reactor and other equipments in the building. In addition, a U-rail and transport carts are installed above the pool for changing fuel in the reactor.

On top of the reactor, in addition to a guide wheel frame for the control rod steel cable, an irradiation tube support platform is also to be added. The clamping opening is adjustable to accommodate different diameter tubes. The reactor top cover is made of organic glass. The cover plate of the other end of the pool is made of aluminum to keep the space above the pool at a negative pressure.

4. Cooling System Design

The main task of modifying the LPR is to improve the cooling ability of the reactor and to raise the rated power. The entire cooling system should be redesigned. The new cooling system consists of the primary water main system, the primary water purification system, the primary water supply system, the emergency water replenish system, the primary water outgassing system, the special draining system, and the secondary water system. (See Figure 3)

The primary water flows through the core, carries out the heat, and is taken out of the pool via the main outlet pipe. The path is then divided into two parallel branches and each branch has a water pump and a heat exchanger. After heat exchange, the water enters the pool via the main inlet pipe. At the rated power, simultaneous operation of the two main pumps provides a flow rate[6] of 690t/h.

The primary water purification system consists of a water purification pump, a pre-mechanical filter, two mixed ion exchange beds and a post-mechanical filter, and the associated piping, valves and meters. The flow rate of purified water is 6.2t/h, the resin is not regenerated and the release of resin can be done in a number of ways. The pH of the purified water can be adjusted by the resin ratio of the ion exchanger.[7]

The primary water replenishment system will use the water supply system and reservoir of the original LPR. Deionized pure water comes from the HFETR water supply pump room.[8] Both the swimming pool and the water replenish tank are equipped with remote water level indicators. When the water level drops, the replenish water pump is turned on to raise the level.

The emergency water replenish system is used in case of major water loss during accidents and when the danger exists for core exposure. Water from fire hydrants will be used to ensure safe operation of the reactor.

The special water drainage system serves the reactor pool, the single crystal silicon water tank, the primary water system, the water purification system, water leakage at the pump axle seal, and shop floor drainage. The waste waters are sorted according to their radiation level and are drained to the waste water treatment plant through special pipes.

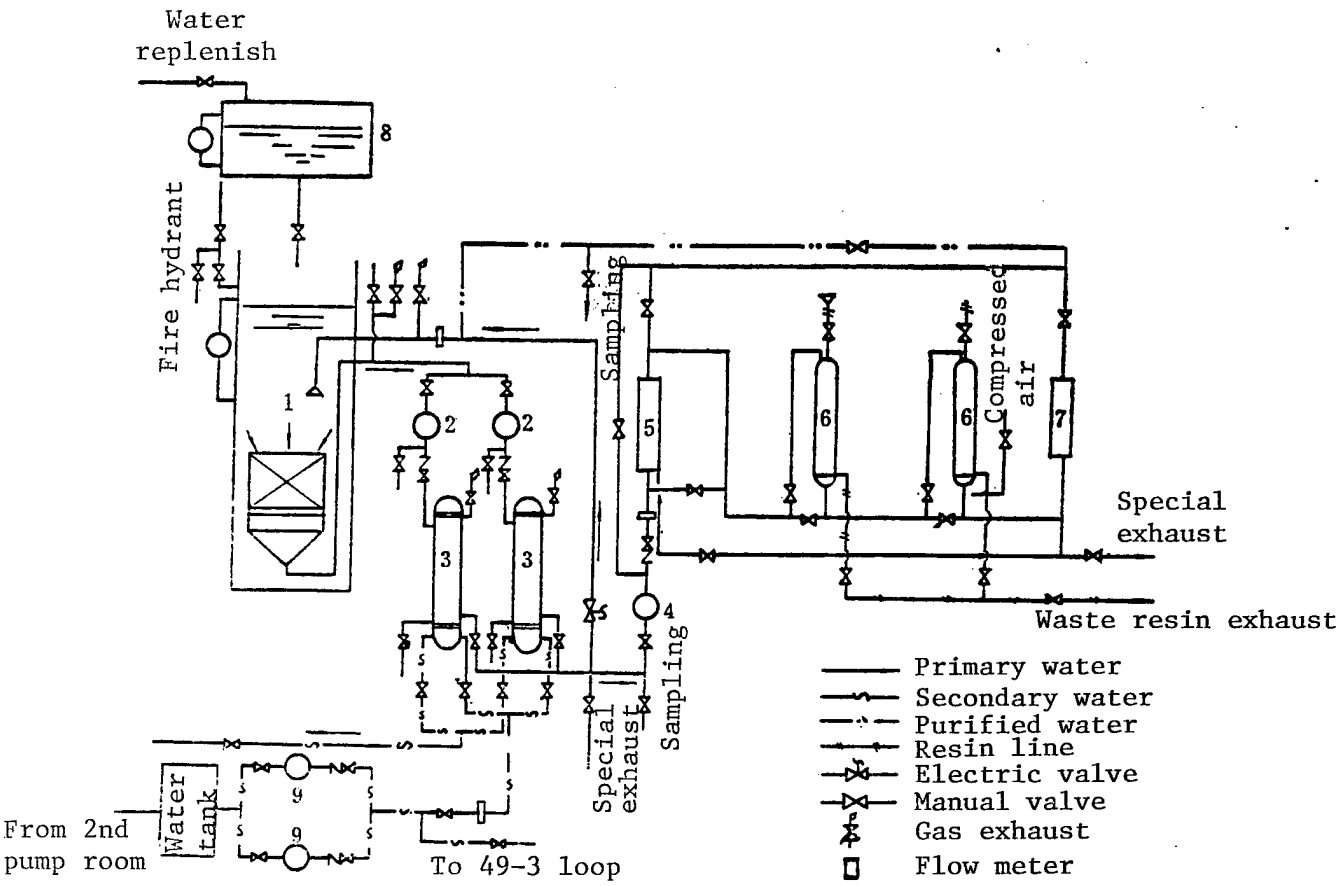


Figure 3. Cooling System of the LPR
1--Reactor; 2--Primary water pump; 3--Heat exchanger; 4--Purification water pump; 5--Fore mechanical filter; 6--Mixing bed; 7--Aft mechanical filter; 8--Replenishment water tank; 9--Secondary water pump

The secondary water system is an open system. In order to avoid an invasion of the secondary water by the primary water due to fracture of heat exchanger tubes, the pressure of the primary water in the heat exchanger must be kept lower than the secondary water pressure. The supply rate[9] of the secondary water is 1000t/h.

5. Monitor, Control, and Protection System[1,10]

(1) Nuclear Monitor System

The monitor system provides three indicators: the neutron count in the source zone, the start power and the operating power level, and the reactor cycle from the source zone to the power zone. It also provides two action signals: the short period of the protection system and the excess nuclear power value. The monitor meters may be operated continuously in the 12 ranges of the nuclear power.

(2) Control System

The equivalent reactivity of the automatic control rods and the manual control rods must satisfy the physical requirements of the reactor. The equivalence of a single automatic control rod is less than $1\beta_{eff}$ and the equivalence of the manual rod is no greater than that of the automatic rod.

(3) Safety Protection and Signal System

The total equivalence of the safety rod is about $13\beta_{eff}$. Both the safety rod and the manual rod may be used for fast or slow descend. Like other control rods, the safety rod is also equipped with automatic angle adjustment and position indicator. The safety rod may be stopped at any position between its upper and lower excursions but the other control rods cannot be activated before the upper travel switch. The free falling time of the safety rod is less than 1 second.

The LPR is equipped with a number of protection signals, including period protection, nuclear power protection, thermal power protection, primary water flow protection, swimming pool water level protection, and external power outage protection. It also has 25 warning signals including nuclear power rise, short period, thermal power rise, and high N^{16} radioactivity.

6. Thermodynamic Measurement System Design[11]

Thermodynamic measurement parameters of the modified LPR can be divided into five parts: the reactor itself, the primary water system, the secondary water system, the purification system, and the water replenish system. The total number of measurables including flow rate, temperature, pressure, water level, and reactor power is 37.

In terms of alarming and protection measures, there are 7 warning signals for out-of-range thermodynamic parameters and 3 protection signals.

7. Fuel Elements Damage Monitoring System[12]

Since the LPR uses fuel elements unloaded from the HFETR, the damage detection system becomes particularly important. The damage detection is based on measuring the slow neutron and the total γ. Under normal operating conditions the primary water coming out of the reactor main pipe is continuously monitored. For unusual conditions the monitor spot can be manually changed on location. The various fuel boxes may also be inspected by periodic manual switching of the monitor locations.

8. Dosage Monitor System[13]

There are eight monitor points for the γ dosage of the LPR. Aerosol and gas monitor is done by a fixed gas sampling system at four points.

The γ dosage and the radioactive gas monitor share one sound-light alarm system. When one or both exceeds the threshold, sound and light alarm signals go off on location and at the control panel.

9. Electric System Design[14]

The LPR has two external power supply circuits. One runs from the overhead power line to the transformer of the building, stepping the voltage from 6,000V to a low voltage, with a capacity of 560kVA. The other circuit comes from the ventilation center of the HFETR and the capacity is 65kVA. Under normal conditions the main parallel switch of the two circuits is closed, the overhead power supplies the two main lines and the power from the ventilation center is used as a reserve supply. When the overhead power is down, the main parallel switch shuts off automatically and the standby source switch turns on automatically to supply power. When the overhead power resumes, the standby source is shut off automatically and the power is supplied by the overhead source. The main facility of the LPR and the lighting of the main shop and the duty room are all powered by the two circuits.

In case both power sources are down simultaneously, based on circuit and thermohydraulic calculations, the inertial flow in the main pump is still capable of carrying away the residual heat and an emergency pump is not needed. The LPR modification design therefore does not call for an emergency power source. Emergency lighting uses charged batteries and light bulbs. Normally the lighting circuit charges the bulbs; in case the lighting circuit is down, the charged bulbs can run for 8 hours.

The electrical design of the 15t hoist of the building is also modified. The cart speed is changed from a fixed speed to a stepless speed control. The centering of the hoist is done automatically by photoelectric means. The x,y motion of the hoist allows an x,y coordinate be placed at center of each irradiation tube with an error of ±5 mm.

All the pumps and valves of the cooling system can be controlled from the screen in the control room or on location. The main control room and the on-location control are interlocked. The on-location switch is placed in the non-remote position. The safety of the maintenance personnel is guaranteed even if the control in the main control room is down.

10. Building Design

The strategy of the building design is as follows: Whenever possible, the existing plant and shop buildings are made use of or modified. The increased building area is mainly used as shops, duty rooms and production preparation room. The area of the new construction is about 600 m^2 and consists of the following:

(1) Modify the original large hoist building, increasing the shield thickness, add a top cover with opening for hoist and for primary water route. Remodel the fuel elements warehouse, leave hoist opening, add protection wall for operating room and for purification system.

(2) Remodel the original ventilation machine room, lower the floor to -3.4 m, install a stainless steel surface for single crystal silicon storage water bath. Add protection wall.

(3) Modify the original main control room into an activation sample analysis and measurement room.

(4) Increase the thickness of the east wall of the main reactor building for better protection and add two stories of open hallway structure as the main control room of the LPR, single crystal operation room, washing room, dosage monitor room, damage detection shop and operation room, and bath rooms.

(5) Outside the south wall of the original main building, build new ventilation machine room which doubles as entrance to the main hall.

III. Production and Research Facilities of the LPR

1. Neutron Doping of Single Crystal Silicon

(1) Single Crystal Irradiation Facility

This facility consists of irradiation can, irradiation tube, transmission mechanism, sectioned rod, and support cover. To make full use of the reflection layer space, 14 sets of irradiation setups of two different dimensions (8 ϕ63x1.5 tubes and 6 ϕ90x2 tubes) may be installed before the installation of the In-Ga-Sn γ circuit. The sizes of the fuel assemblies, beryllium blocks and aluminum blocks are the same and the bases of the positioning tubes are also of the same size for versatile loading. To accommodate different size single crystals the irradiation tubes of two sizes are also interchangeable.[15]

The transmission mechanism ensures circumferential uniformity of the irradiation by rotating the irradiation can and the crystal at a uniform rate of 5 rpm. The multi-section rod connects the transmission mechanism and the can and rotates the can.

(2) Integrated Neutron Flux Measurement System

This system consists of a self-energy detector and an integrated neutron flux meter. It scans the instantaneous thermal neutron flux at the tube positions and measures the integrated thermal neutron flux. It also issues warnings and keeps records.

(3) Design of the Technical Transport System[16]

The design takes into account the hard and brittle nature of silicon and strives for a uniform irradiation of the sample. The procedure for neutron doping is as follows: washing of the single crystal, loading into the can, labelling —> loading assembly into reactor —> slowly rotating the assembly and start reactor, monitoring neutron at the same time —> after a predetermined time, stop the rotation and shut down the reactor, remove the assembly —> hoist the assembly into the storage reservoir for decay —> axially invert the assembly —> reload into the reactor —> ····· —> after desired irradiation, remove and wash crystal —> examine sample and package for shipping.

In order to implement the above steps, the following devices are used: single crystal silicon storage water tank, dedicated water-bath transport cart, automatic grab for loading and unloading, large and small observation windows, and modified 15t/3t hoist.

2. M_0-T_c "Cow" Production

The production flow chart includes: M_0O_3 target irradiation, target cutting, gel preparation, column packing and analysis. The M_0O_3 irradiation device consists of ϕ63 Al tube and the irradiation can. The tube is placed in the vertical channel at position K_{II} at the center of the reactor. To increase the thermal neutron contribution, a dry channel may be used. After the can is taken out of the reactor, it is placed in a lead can and transported to the hot room for cutting. The LPR only accommodates M_0O_3 target irradiation.

3. Neutron Activation Analysis

The neutron activation setup includes: irradiation device, purifier, divider, sample storage, stripper, timer and Ge(Li)γ spectrometer. The system is modified from a setup outside the HFETR.

This design is a joint effort of the physics laboratory of the First Division in the First Institute, the theoretical physics group of the Third Institute, the thermo-hydraulics laboratory, the reactor structure laboratory, the electrical circuit laboratory, the control meter laboratory, the experimental physics laboratory, technical safety laboratory of the First Division, and Lu Guangquan [0712 0342 0356], Xiao Xunze [5135 8113 3419], Jiang Binsen [5592 3453 2773], Chen Hongzhang [7115 1347 3864], Peng Feng [1756 7364], Tang Xueren [0781 1331 0088], Wu Ganye [0702 0049 2814], Xie Jingwen [6200 2529 2429], Zhang Guanghai [1728 0342 3189], and Shi Jingxian of the LPR Remodel Group. The building design is provided by the building design laboratory of the First Institute. This paper is mainly based on the design and data of the workers above.

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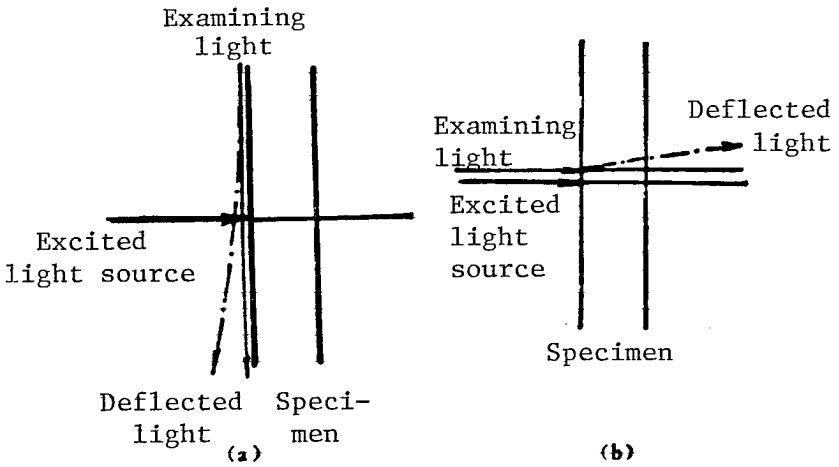
9698/6091
CSO: 4008/43

PHOTOTHERMAL DEFLECTION SPECTROSCOPY

Beijing WULI [PHYSICS] in Chinese Vol 16, No 3, Mar 87 pp 141-145

[Article by Zhu Meifang [2612 5019 5364], Graduate School, China University of Science and Technology]

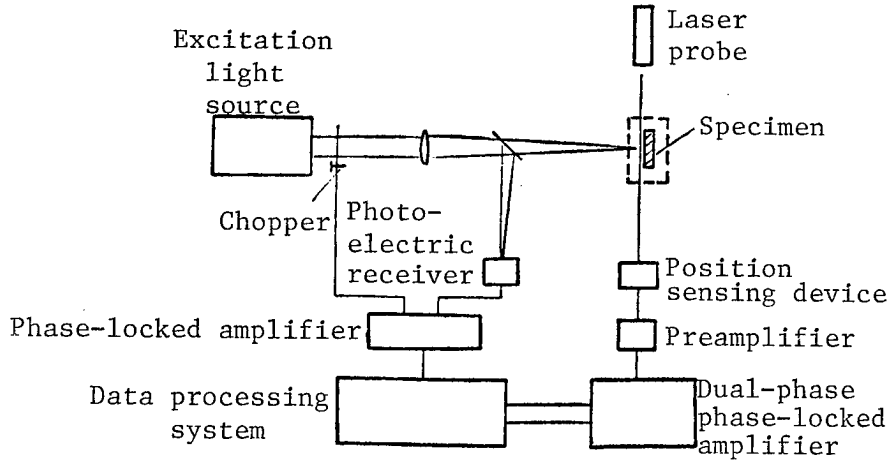
[Abstract] Photothermal spectroscopy was developed only recently. In its basic principle, electromagnetic wave energy is converted into heat energy, thus raising the temperature of the medium after it has absorbed electromagnetic waves. This heat energy can be examined with different coupling methods, and thus the optical properties of the material will be determined. According to the different analytical approaches, photothermal spectroscopy can be divided into the interference spectroscopy, heat mirror spectroscopy, optoacoustic spectroscopy, and photothermal deflection spectroscopy. These photothermal spectroscopic techniques are highly sensitive for successful application in determining the optical properties of materials; in particular, optoacoustic spectroscopy is gradually becoming familiar to researchers and is widely applied. Photothermal deflection spectroscopy is even newer than optoacoustic spectroscopy; the former is higher in precision and can avoid coupling difficulties when successfully applied in chemistry and physics, especially in studying the optical properties and defects of amorphous semiconductor solid thin films.



Schematic Diagram of Photothermal Deflection Spectrum

(a) Lateral direction measurement; (b) Collinear type measurement

The following schematic diagram shows the measurement of a lateral-direction photothermal deflection spectrum.



Three other figures show the photothermal deflection angle spectrum, the relationship between photothermal deflection signal and mole concentration of ethylene in nitrogen gas, and the absorption characteristics of an amorphous superlattice material. One table lists the main features of several photothermal spectroscopies.

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APPLICATIONS OF GAS DISCHARGE PLASMA IN THIN FILM TECHNOLOGY

Beijing WULI [PHYSICS] in Chinese Vol 16, No 3, Mar 87 pp 157-160

[Article by Wen Lishi [5113 4539 2514], Institute of Metals, Chinese Academy of Sciences]

[Abstract] This is the eighth lecture in a series describing plasma science, its technology and applications. The extensive applications of plasma in thin film technology lead to the rapid advances in thin film materials. The high-energy charged particles and neutral particles in gas discharge plasma are helpful in overcoming the energy barrier in gas-phase chemical deposition reaction by affecting the dynamic process and modifying thin film structure and properties in order to make materials difficult to produce with other techniques. The paper goes on to describe the gas discharge plasma and gas-phase depositing technique, as well as the function of the gas discharge plasma in the latter. Three figures show a reactor for plasma accretion chemical vapor deposition (PACVD), the principle of a transmitting frequency splash apparatus, and a plasma deposition apparatus with a microwave guide discharge.

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NOVEL GEOSONAR--'GPY' HIGH RESOLUTION SUBBOTTOM PROFILER

Beijing YINGYONG SHENGXUE [APPLIED ACOUSTICS] in Chinese Vol 6, No 2, Apr 87 pp 1-6

[Article by Hua Luosun [5478 2867 5549], Institute of Acoustics, Chinese Academy of Sciences]

[Abstract] The paper presents a high resolution subbottom profiler (GPY) operated in very shallow water. The GPY profiler uses an improved type of electromagnetic pulsed acoustic source. Multiple layers of air and sound reflecting material serve as baffles for the GPY transducer base array.

First, the technical problems are analyzed as exemplified in products available in the international market. Then, new techniques used in the GPY are described. Finally, the main specifications and applications of the GPY are stated. GPY signal processing involves time-varying filtration, digital multi-superpositioning, digital cancellation of residual shock, dual TVC compensation, and automatic tracking along the seabed. Following the successful development of GPY, the cumulative survey line came to 7,000 kilometers, proving its effectiveness. The average penetration depth in Lake Taihu surveyed with the GPY is 30 to 40 meters; these depths are beyond the capabilities of foreign instruments.

One table lists the specifications of the GPY compared with similar foreign instruments. Nine diagrams show ghost images, sounding records of Japanese and American profilers, acoustic base array (and its echo recording) of the **GPY** profiler, comparison of base array orientation of the GPY and a foreign instrument, experimental recordings with cancellation of residual shock, and GPY sounding records. The paper was received for publication on 2 July 1986.

SYSTEM FOR RANGING OF UNDERWATER EXPLODER SOUND SOURCE

Beijing YINGYONG SHENGXUE [APPLIED ACOUSTICS] in Chinese Vol 6, No 2, Apr 87 pp 6-9

[Article by Xu Zhenyong (since deceased) [6079 2823 6978], Wu Guanjuan [0702 0385 0689], Xu Qinshan [1776 2953 0810], Guo Hongxin [6755 3163 0207], Wang Zhihui [3769 2535 1979], Zhang Meize [1728 2734 3419], Zheng Baowen [6774 1405 3306] and Liu Caifen [0491 1752 5358] of Institute of Acoustics, Chinese Academy of Sciences]

[Abstract] The paper presents a high precision microcomputer-controlled passive ranging instrument for an underwater exploder sound source. The instrument is used at an experimental site for monitoring mobile sound sources or other detonation sound source, for ranging the distance between the sound source and the instrument, and for measuring the time lag between water impact and triggering. Based on the underwater passive ranging principle, the instrument uses a long straight line underwater microphone base array, a single board microcomputer, and other special hardware and software for complete automation of the entire ranging process. Four figures show the ranging principle, the instrument arrangement, and flowcharts of the main program and subroutines. The paper was received for publication on 31 March 1986.

10242/12859
CSO: 4009/52

NEW LASER AID FACILITATES NUCLEAR FUSION STUDY

OW270754 Beijing XINHUA in English 0649 GMT 27 Jun 87

[Text] Shanghai, 27 Jun (XINHUA)--A high-powered laser aid which passed state assessment here today is now open to foreign scientists in laser nuclear fusion experimentation.

Called "Shenguang" or "Magic light", it was developed by the Shanghai Optical Machinery Research Institute in July 1985 and has been used for trial operation since then.

"Shenguang" has an output power of 1 billion kilowatts, and a luminescent time of one-1,000,000,000th to one-10,000,000,000th of a second.

Through focusing, it emits a power of 100,000 billion kilowatts per square centimeter to a target with a diameter of 100 microns to cause the temperature of the surface of the substance on the target to rise to 10 million degrees centigrade, creating special high-density plasma.

The aid will facilitate the study of laser nuclear fusion, astrophysics, atomic physics, high temperature and pressure, and high-density plasma.

"Shenguang" is made up of 80 precision meters, instruments, and equipment items, and involves techniques from precision machinery, optical materials and micro-computers. At present, only a few countries like Japan and the United States are able to produce this type of laser aids.

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CSO: 4010/58

BRIEFS

DEHA PRODUCTION FACILITY CERTIFIED--The 150-200 t/a DEHA production facility developed and operated by the Organic Synthetics Plant of the Jilin Chemical Industries has been certified. DEHA is a polymerization inhibitor of ethenyl or diene monomers and is an indispensible assistant in the production of synthetic rubber. DEHA samples have been used in the production of butylbenzene rubber at the Jilin Plant. Results show that DEHA can effectively terminate the polymerization of free radicals in the liquid or gas phase and prevent the formation of terminal group polymers. It can alleviate or prevent plugging of pipes in the monomer recovery system. The quality of the product rivals similar foreign material. The evaluators believed that the production technology is advanced and the facility is ready for manufacturing. It was recommended for promotion to the rest of China [Text] [Lanzhou HECHENG XIANGJIAO GONGYE in Chinese Jan 87 p 71] 9698/12951

MEDICAL GRADE SILICONE RUBBER ADHESIVE--The quality of the SDG-A(M) medical grade silicone rubber adhesive developed by the Shanghai Institute of Rubber Products has reached national standard. This adhesive solved a number of difficult problems in artificial organs, medical instruments, and implanted silicone products. It made possible the implementation of a new generation of complex, odd-shaped novel medical products with valves, air sacs, and multiple cavities. It has considerable clinical and economic benefits. It has already been used in the drainer tube with medication and control devices for hydrocephalus, in peritonacum dialysis tubes, and in different air sacs. Biological tests show that the SDG-A(M) adhesive meets medical requirements. [Text] [Lanshou HECHENG XIANGJIAO GONGYE in Chinese Jan 87 p 72] 9698/12951

CAST POLYAMIDE ELASTOMER--Since 1983 the Shanxi Provincial Chemical Institute have imported 33 sets of cast polyamide elastomer casters. After some technical modifications, the Institute has developed a complete production line from raw material processing to parts manufacturing. The production line was officially put into operation in October 1986 and the output is 400 t/a. This production facility improved the production efficiency and precision and produces parts of all sizes. This facility will provide oil resistant, wear resistant, high strenght, and high elasticity plastic rolls, sealed parts, shaft couplers and sieve plates for the steel, mechanical, electronic, textile, and printing industries. [Text] [Lanzhou HECHENG XIANGJIAO GONGYE in Chinese Jan 87 p 72] 9698/12951

HIGH TEMPERATURE LARGE STRAIN ADHESIVE--Strain adhesive or strain glue is a special strain sensitive material. The demands on such materials has increased with technological developments in electronics, communication, transduction, testing and measurements. Currently available foreign-made strain glues can stand either high temperature or large strain but not both. With the help of Institute 629 of the Ministry of Aeronautics, the Hubei Institute of Chemistry developed a strain glue that can stand high temperature (300°C) and large strain (8 percent). This material recently passed provincial and ministry level certifications in Shaanxi. Experts believe that this high temperature glue has a strong adhesion and a high sensitivity of strain transfer. It is stable, reliable and has a large peel strain (11-14 percent). This new material will help the development of high temperature, self-compensating plasticity strain gage and improve the performance of such gages. It filled a void in China's aerospace, geology, steel, machine, hydroelectric, atomic energy, and building construction industries. [Text] [Lanzhou HECHENG XIANGJIAD GONGYE in Chinese Jan 87 p 73] 9698/12951

AROMATIC BOND EXPANDING AGENT--The Shanxi Institute of Chemical Engineering recently developed an inert aromatic diamino bond expanding agent (MIHA). Good results have been obtained in casting polyurethane elastomers. MIHA has the appearance of brownish yellow powder, its molecular weight is 280-330, its melting point is 110-160°C and it has low toxicity. As a bond expanding agent in pre-polymerization casting, MIHA has a lower amino activation than MOCA. At higher temperature there is no air entrapment upon mixing with pre-polymer and casting loss is low. At lower temperatures it does not block the tubes of the tool and the casting speed can be increased by a factor of 4 to 8. MIHA may be used in one-step casting to lower the costs and to improve the physical and mechanical properties of the casts. MIHA are especially suited for large scale casts, hard materials, and complicated thin wall structures. [Text] [Lanzhou HECHENG XIANGJIAO GONGYE in Chinese Jan 87 p 73] 9698/12951

S-4 THIOLOL SEALER--The Shanghai Institute of Rubber Products developed a S-4 thiokol sealer for refrigeration lockers. Tests conducted by the Shanghai Sanitation and Immunization Station showed that the sealing agent released no hazardous materials. The material is now certified. The S-4 sealer is gray in color. Its main constituent is thiokol and also contains special resin and promoters. The sealer resists machine oil, acids, alkalines, heat, and temperature cycling. It can be sulphurized at room temperature and has good tack properties. It has good sealing power and adhesion to aluminum, iron, galvanized iron, steel, bakelite, concrete and other metals and nonmetals. The sealer was tested by shipping building facilities and by the Shanghai Swimming Pool and showed reliable performance, especially against water. The sealer has large adhesion area and seals aluminum, zinc, glass, concrete very well. It is an ideal sealing agent for refrigeration lockers. Compared to welding, it saves labor by a factor of 4 or more and the economic benefits are great. [Text] [Lanzhou HECHENG XIANGJIAO GONGYE in Chinese Jan 87 p 73] 9698/12951

SPECIAL RUBBER, THERMOPLASTIC CONFERENCE--The Rubber Society of the Chinese Chemical Engineering Association held a technical conference on the application of special rubbers and thermoplastic elastomers on 14-21 November, 1986, in Tongling, Anhui. One hundred and eighteen representatives from 73 colleges and universities, research institutes, and plants and mines participated in the meeting. Fifty five papers were presented on topics including special rubbers, thermoplastic elastomers, synthesis of rubber and plastics hybrids, property modification, testing and analysis, structure and properties of synthetic materials, manufacturing, and applications. The reports made broad and in-depth discussions of these topics and introduced newest foreign developments and trends. In the meeting, most recent research results were reported by six research institutes, including Yanshan Petrochemical Company Lanhua Company, Beijing Rubber Industry Research and Design Institute, and Changchun Applied Chemistry Institute. [Text] [Lanzhou HECHENG GONGYE XIANGJIAO GONGYE in Chinese Jan 87 pp 73, 70] 9698/12951

CHINA TO BUY CHLOROPRENE FACILITY--The September 1986 issue of the Plastics and Rubber Weekly reported that, according to Xinhua News Agency, China Chemical Engineering Construction General Company has signed a $102M contract to purchase chloroprene production facility from Du Pont. According to the agreement, China will import three 10,000t/a production lines. [Editor's note: this refers only to the post-processing system] The facilities will be built around the end of 1987 at Qingdao Chemical Engineering Plant, Shanxi Provincial Chemical Engineering Plant, and Changshou Chemical Engineering Plant. [Text] [Lanzhou HECHENG XIANGJIAO GONGYE in Chinese Jan 87 p 70] 9698/12951

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QUICKER DEVELOPMENT OF NONFERROUS METALS INDUSTRY URGED

Lanzhou GANSU RIBAO in Chinese 2 Mar 87 p 2

[Article by Zhou Fengqi [6650 7364 1477], manager of the Lanzhou branch of the China Nonferrous Metals Industry Co and the Gansu Provicial Nonferrous Metals Industry Co: "Speed Up the Development of the Nonferrous Metals Industry in Gansu"]

[Text] With its great wealth of nonferrous metals, Gansu is one of China's major nonferrous metal industrial bases. In the past few years, with the implementation of the policy of reforming the economic structure, opening to the outside world, and invigorating the domestic economy and a series of other policies, the nonferrous metal industry in Gansu has entered a new stage of development characterized by the participation of the state, collectives, and individuals, state, local, and township enterprises. In 1986, nonferrous metals output of Gansu's major enterprises increased by 11 percent over 1985; their total output value increased by 4.85 percent; and their profits and taxes increased by 13.22 percent. The total amount of profits and taxes turned over to the state by the nonferrous metals industry in Gansu in 1986 was higher than in any other province. Nonferrous metals exports earned $12 million in 1986, an 89.87-percent increase over 1985. Small and medium-sized local nonferrous metals enterprises have also grown rapidly. Their output, output value, and profits and taxes in 1986 increased by 23 percent, 38.4 percent and 51.6 percent respectively over 1985.

However, the great potential of Gansu's nonferrous metals industry has hardly been tapped. Gansu is very rich in nonferrous metals deposits. Not only are there large reserves of different kinds and types of high-grade ores, but most of them are paragenetic deposits of associated ores which are shallowly buried, can be mined easily, and will bring good economic returns on the investment. So far, deposits of 18 nonferrous and rare and precious metals have been verified in 89 places. Proven reserves of nickel, lead, zinc, and such rare and precious metals as cobalt, platinum, and palladium are among the richest in China. Energy resources are fairly plentiful in Gansu. More important, after more than 30 years of hard work, we have already established a complete and well-coordinated nonferrous metals industrial system ranging from geological prospecting to scientific research and designing, capital construction, mining and ore dressing, smelting and processing, equipment manufacturing, and cultural

educational, and public health work with more than 100,000 workers and 11,469 scientific and technical personnel. The party Central Committee, the State Council, the Gansu provincial party committee, and the provincial government all attach great importance to developing the nonferrous metals industry in Gansu. During the Seventh 5-Year Plan, the state is to undertake some major construction projects in Gansu, including the second phase Jinchuan extension project, the Baiyin aluminum plant, and the northwest lead and zinc production base. Toward the end of the Seventh 5-Year Plan, Gansu's total nonferrous metals output, total industrial output value, and profit and tax revenues will more than double those in 1983. By the end of the century, powerful industrial bases completed will include: the nickel, copper, cobalt, platinum, and heavy chemical industry base with Jinchuan as the center; the copper, lead, and zinc smelting and processing base with Baiyin as the center; the lead and zinc mining and raw materials base in southern Gansu with Xihe and Chengxian as the centers; the Longxi aluminum processing base; the Gansu rare-earth element production base; and two "small nonferrous metals seas" in southern Gansu and west of the Huang He. By that time, Gansu's nonferrous metals industry will play an even more important role in the provincial and national economy.

The Seventh 5-Year Plan is also a period of uphill struggle for Gansu's nonferrous metals industry, particularly during 1987 and 1988, and we must rely mainly on tapping the potential capacities of existing enterprises to maintain steady growth. We are conscientiously implementing the State Council's policy on invigorating the enterprises. On the basis of all-round implementation of the system under which the factory manager assumes full responsibility and the system which requires him to fulfill specific goals during his term of office, we are actively implementing the contract system on a trial basis in selected units and continuing the reform of the wage and reward system. Depending on the circumstances, different pay systems are used, such as combining fixed wages with floating wages, piece rate wages, contract wages, regular wages plus bonuses, and so forth, to arouse the enthusiasm of managers and workers to increase production and practice economy.

Of course, increasing production and practicing economy must be based on constantly improving quality, decreasing consumption, and marketable products. Our companies' products are generally in great demand, but there is still room for improvement in quality and reduction in consumption. Much can be done in these areas. At present, we are strengthening management and mobilizing the masses to tap potential capacities and strive to increase nonferrous metals production by 23,000 tons and gold production by 100 kg this year. At the same time, we have launched a campaign to improve quality and reduce consumption, striving to achieve the following goals this year: to win one national quality award and 20 ministry quality awards; to make sure that the quality of more than 90 percent of the products is steadily improving, and that quality products account for more than 70 percent of the total output value; to make sure that consumption of raw and semifinished materials, fuel, and power is being steadily reduced in more than 80 percent of the production units; and to save 15,000 tons of standard coal and 24 million KWH of electric power this year.

This year, construction of nonferrous metal production facilities in Gansu has entered its peak phase. Following the principle known as the "three guarantees

and three restrictions" [guarantee the construction of projects included in the plan, of productive projects, and of key projects, while restricting projects that are outside the plan, nonproductive, and not key projects], we are stepping up our efforts to strike an overall balance. The practice of public bidding is being used increasingly in capital construction, and efforts are being made to strengthen engineering quality control, increase construction speed, and bring investment returns as quickly as possible. To further increase the capacities of old enterprises, efforts have been concentrated on their technological transformation. In the past year, our companies have completed 16 major technological renovation projects, which have brought an increase of 30 million yuan in output value, 3 million yuan in taxes, and 4 million yuan in profits, and saved 8,000 tons of standard coal. During the Seventh 5-Year Plan, 25 percent of our companies' increase in output value and 22 percent of increase in profit will come from technological renovations.

The small and medium-sized local nonferrous metals enterprises in Gansu have also grown rapidly. The number of mines has increased from 32 in 1983 to 138 now. Their growth has followed a pattern: They have developed from simple mining operations into combined mining and ore-dressing enterprises with strengthened technological control and increasing economic returns. Our companies have always regarded supporting these small and medium-sized enterprises as an important task. We have helped them solve problems in production and construction, coordinate production and marketing, develop technical consultations, train technical personnel, and improve management standard in order to speed up the process of turning Gansu's nonferrous metals resources into economic prosperity.

Looking ahead, we are filled with confidence. In 1987, we must pay attention to the positive education on upholding the four cardinal principles, step up the development of the spiritual civilization, carry out the campaign to increase production, practice economy, raise revenues, and reduce expenditures, and contribute our share to developing the nonferrous metals industry and enhancing the economic prosperity of Gansu.

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2 SUCCESSFUL RESEARCH INSTITUTES SET UP BY INDIVIDUAL

Beijing GUANGMING RIBAO in Chinese 22 Mar 87 p 1

[Article by staff reporter Liu Jingzhi [0491 2417 2535]: "Li Taihang Set Up Two Scientific Research Organizations Which Are Responsible for Their Own Profits or Losses"]

[Text] The Shanghai Modern Information Technology Research Institute and the Shanghai Modern Information Technology Co., established by Li Taihang [2621 1132 5300], a middle-aged industrialist, have in the past 2 years carried out 38 research projects, of which 4 are the first of their kind in China and 2 are of advanced international level. In 1986, the research institute had an after-tax profit of 430,000 yuan. They have also set up nine joint ventures in different parts of the country, whose output value broke the 15-million-yuan mark in 1986.

Li Taihang is 42 years old. When he worked as an associate research fellow at the Shanghai Computing Technology Institute, he won a national award for major scientific and technological achievement, a national science conference award, and many Shanghai municipal awards for major scientific and technological achievements. Since 1978, he has published 54 academic papers at important international meetings and in publications at home and abroad. In the field of computer theories, he is regarded highly as the founder of his own "Oriental school."

He understood clearly the problem of the scientific and technological management system. It is like playing a soccer game with too many "side passes." By the time an advanced technological achievement goes through level after level of examinations and approvals and is finally turned into a product, it has already become obsolete. He suggested that some scientific research entities which are not hindered by "side passes" be set up so that results of scientific research can be turned into greater real benefits. His idea was approved by Shanghai's leading comrades. In 1984, with the municipal government's support, he cast away his iron rice bowl, gathered a group of people, and set up two scientific research organizations with funds raised by themselves and assuming sole responsibility for their profits and losses.

At the two institutions established by Li Taihang, selection of research projects is based on market surveys confirming they are needed by the

national economy. They regard continuing development of new technologies as their basic way to survive and grow in competition.

Their research projects are divided into two categories: less sophisticated technologies which can be put into production and produce economic results quickly, and high-tech projects which take longer to develop. Both must meet high standards and quality requirements. It took them just 1 year to successfully develop and put into regular production a high-concentration universal chromogen. The technology is of advanced world level and has now become one of Shanghai's major technological exports. An infrared collimator has been developed. It is a key technological development project, and the product is now being appraised. No similar product has yet been reported elsewhere in the world. Another high-tech product, an infrared alarm, is being put into serial production. It works better than the same kind of foreign-made products.

For a variety of reasons, the research institutions established by Li cannot pay employees high wages. However, by adhering to the principle of distribution according to work and encouraging progressiveness, they still have a strong attraction to scientists and technicians. Most of the people who have joined the two research institutions are scientists and technicians who had no chance to do what they were trained to do at their former units. To them, the most important thing is not money, but work. Li Taihang makes a point of finding ways to satisfy their aspirations for work. He has full confidence in them, tries to bring each person's ability and special skills into full play, and encourages them to choose working partners freely among themselves and do their work boldly. Satisfied with their work, many of the scientists and technicians have turned down high-pay job offers by other organizations, and continue to dedicate themselves to developing new technologies where they are.

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REFORM OF S&T MANAGEMENT SYSTEM IN 1986 DESCRIBED

Beijing KEJI RIBAO in Chinese 27 Mar 87 p 1

[Article by staff reporter Chen Dong [7115 2639]]

[Text] In 1985, China made some progress in reforming its S&T management system. The emphasis was placed on reforming the state funding system and implementing the system of recruiting technological specialists by invitation. Attention was also paid to consolidating and perfecting the results already achieved, continuing to develop the technology market, and quickening the process of commercializing technological achievements.

In reforming the state funding system, the principle of "carrying out reforms with determination, treating different research institutes differently, dispensing funds in different ways for different categories of projects, and ensuring steady progress" was followed. To implement the principle, a review was made of the operating expenses, which came to several billion yuan, of nearly 10,000 research institutes at and above the city and county level under 52 central ministries and commissions and the 29 provinces, autonomous regions, and municipalities directly under the central government. The operating expenses for technology development institutes as a whole were slashed by more than 10 percent. Some 320 institutes of this type were completely cut off from state-appropriated operating funds and became economically independent. The operating funds thus saved were used partly by various departments to support key S&T projects or provide technological services for various industries, and partly to set up S&T credit funds in support of S&T development. At the same time, state appropriations for S&T development increased by 6 percent.

Research institutes engaged in various forms of social services, which continued to receive state funds, began on a trial basis to assume responsibility for their surpluses and deficits. In 1986, a national natural science foundation was formally established. It received grant applications from 2,000 units and 100,000 people on 12,000 project proposals, and approval was given to 3,432 projects. Financial support totaling more than 90 million yuan was given to the most promising basic and applied research projects chosen through open bidding or consultations among experts in the relevant fields. A China New Technology Investment Co. opened for business in 1986. It raised more than 40 million yuan and spent nearly 20 million yuan on new

technology development projects, blazing a new trail for cooperation between financial institutions and scientists and technicians. These reform measures have strongly aroused the enthusiasm of the research institutes and scientists in various fields.

In the area of position title reform, the Central Position Title Reform Leading Group, with the State Council's approval, circulated the regulations governing titles of professional and technical positions in 21 fields of work and opinions on their implementation. It also approved the experimental plans on position title reform submitted by the provinces, autonomous regions, and municipalities directly under the central government and 67 ministries and commissions. In 1986, reform of position titles began in higher education, scientific research, and public health institutions directly under provincial governments or central ministries. Experiments were also conducted in selected units in a well-planned manner. Since the implementation of the new recruitment system, a large number of outstanding young and middle-aged professional and technical workers have been given promotions and appointments ahead of others, and professional and technical jobs at the higher, middle, and lower levels are being restructured in a more rational way. There is a growing sense of urgency among the scientific and technical personnel to work hard and make progress.

In 1986, progress was also made in developing the technology market and commercializing technological achievements and in promoting cooperation between research institutes and production units and enhancing the capacity of enterprises for technological development. Initial statistics of 10 provinces and cities and 5 ministries and commissions alone showed that nearly 20,000 technological and trade contracts worth 600 million yuan were signed in 1986. Nearly 10,000 cooperative organizations of various forms were established between research institutes and production units.

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FORMER CAS VICE PRESIDENT DISCUSSES ACADEMY EXPERIENCE

Beijing KEJI RIBAO in Chinese 27 Mar 87 p 2

[Article by staff reporter Bie Qinghe [0446 3237 3109]: "A Veteran Scientist on the Go; an Interview With Yan Dongsheng, CPPCC Member and Special Adviser to the Chinese Academy of Sciences"]

[Text] He walked up a flight of steps with agility and passed by me.

"This is CPPCC member Mr Yan Dongsheng."

I was a little surprised by the introduction. This over-60-year-old was healthy and energetic like a young man. He readily grabbed my hand and had me sit down beside him. "Do you play tennis, young man? I play several times each week," he said.

Our conversation quickly turned to the election of the current leading body of the Chinese Academy of Sciences. Since 1981, Comrade Yan Dongsheng [0917 2639 3932] has served as the CAS' vice president and leading party group secretary. He and President Lu Jiaxi have run the CAS together for 6 years.

"It can be said that those are the happiest 6 years in my life." Yan Dongsheng, an expert in materials science who returned to China in 1950 after obtaining his doctor's degree in the United States, told me with his characteristic frankness: "In those 6 years, with the full cooperation of the CAS' tens of thousands of scientists, technicians, workers, and staff members, I and Comrade Lu Jiaxi have done several things which I always wanted to do, and we have achieved some results. The most important thing is to promote the integration of science and technology with the economy. In the past, out of thousands of results produced by the CAS each year, only 10 to 20 percent were applied to production. This has now increased to more than 70 percent."

"Besides," he continued, "the CAS has also achieved some results in developing the high-tech industries in the past 2 or 3 years. Several highly promising firms, like the Keli, Xintong, Xiwang, and Sanhuan companies, have been set up."

"Will you tell us something about your lifelong pursuit in materials science?" I know that despite his heavy leading responsibilities, he has never given up his specialized study. When he went to Shanghai on official business, he often found time to hold discussions with scientists and technicians at the Shanghai Silicate Institute on questions of materials science and gave them many valuable opinions.

"Talking about materials science," he said, "this is one of the fields of research in which we hold a strong edge and are among the most advanced in the world. Take the Shanghai Silicate Institute for example. Exports of crystal materials developed and produced by the institute totaled more than $2 million in 1986. Dr Ding Zhaozhong's laboratories have used our crystal materials in high-energy fundamental particle detectors, and the result is a tenfold increase in sensitivity over similar types of detectors."

Now, he turned to another subject: "Both I and Comrade Lu Jiaxi have served too long as leaders of the CAS. It began as a 2-year term, then changed to 3 years, and again extended to 6 years. I and Comrade Lu Jiaxi are both approaching 70, and it's time we let younger comrades play the leading roles. Comrades Zhou Guangzhao [6650 0342 0664], Sun Honglie [1327 3163 3525], and Hu Qiheng [7579 0796 5899], who came to work for the CAS one after another, have displayed their abilities on their respective leading posts in the past 2 or 3 years, and they are both in their 50's, the prime of life. Therefore, I and Comrade Lu Jiaxi submitted our request for retirement to the central government last year."

I recalled that Dr Yan was invited to give lectures in West Germany in spring 1986. And Dr Yan's answer at that time was that he could not accept then, but might be able to do so in the next spring. So he was anticipating retirement from the CAS even then.

"So, you can really go to West Germany to give lectures this year?"

"The date has been set. I will leave for West Germany in May this year. Before that, I will go to Shanghai to meet with Dr Ding Zhaozhong, who is going to make a special trip to China. During my lecture tour, I will also attend two international meetings, the European materials science conference and the high-energy particle center meeting, the latter to be held in Switzerland." I figured that international scientific and technological activities and meetings alone have filled up Dr Yan's schedule this year.

"That is not all," he said. "As a special adviser to the CAS, I will do what I can for the CAS' reform. Recently the CAS and the State Economic Commission began negotiations on establishing a fund aimed at integrating science and technology with the economy, and I will be the honorary president of the fund. This is another practical step in reforming the CAS, and I will help Comrade Zhou Guangzhao and others to make it a success."

We had talked for more than 1 hour before we knew it, but Dr Yan did not look tired at all. He said that in addition to doing the previously mentioned things, he also wants to concentrate on materials science research, his own field of specialization. With a meaningful smile, he said: "Now you should know why I walk fast, play tennis, and swim. For my work, I must be physically strong and energetic."

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CAS OFFICIAL DISCUSSES BASIC RESEARCH

Tianjin JISHU SHICHANG BAO in Chinese 25 Mar 87 p 1

[Article by staff reporter Liu Zongxiang [0491 1350 4382]: "Cooperation for Economic Development; Cao Tianqin, Member of the Scientific Council of the Chinese Academy of Sciences, on Basic Research"]

[Text] Recently, during a work conference of the Chinese Academy of Sciences, this reporter paid a visit to Professor Cao Tianqin [2580 1131 2953], director of the CAS Biology Department and president of the CAS Shanghai Branch. The professor has devoted many years of his life to muscle protein, plant cell, and X-ray diffraction research and distinguished himself with outstanding achievements including numerous writings. Although he is over 60, he is still glowing with health and radiating vigor. He received me warmly.

"What is happening to basic research in the reform of the science and technology management system?" I asked, coming straight to the point. "The objective of further reforms at the CAS is to bring about a benign cycle between research and production through the 'double-open' policy," he said with enthusiasm. "While reforming the management system, the CAS has mustered competent personnel to continue the fundamental work for basic and applied research, the necessary work to follow high-tech developments, the establishment of national laboratories and the national scientific research engineering center, the resources survey, the opening of laboratories to other institutions, and so forth. The fundamental work for basic and applied research is extremely important. We must look far into the future and pay attention to basic research."

I asked Professor Cao to comment on the relationship between basic research and application of scientific and technological achievements in economic development. He said: "Several CAS technological institutes are now doing very well in development research and in forming lateral ties with enterprises, such as the Shanghai Silicate Institute, the Beijing Microbiology Institute, and so forth. However, they are still relying on the basic knowledge that has been in use in applied research for more than 30 years. Unless we step up our basic research, we will one day find ourselves at the end of our development ability. Therefore, we must step up our efforts in basic research while carrying out reforms, which will also give added momentum to the continuous development of lateral associations. Basic

research, applied research, pilot-scale experiments, development, and production are the organic components of the scientific research process, and none can be dispensed with. It is a division of labor, without which the result will be retrogression." He continued: "To serve economic development, we must strengthen cooperation, both within and without the CAS. We now have department ownership and even 'private ownership' in research project groups, which are no good. I am for 'sharing the water with others.' Without cooperation, there is no future."

I asked: "You have gone abroad frequently in the past few years on lecture and observation tours. How are the results of basic research sold as commodities in the developed countries?" Professor Cao thought for a while and he said: "In the past few years, I have visited the United States, Canada, Australia, Japan, Britain, France, West Germany, Italy, the Netherlands, Belgium, Sweden, and Finland, and toured some bioengineering research institutes and enterprises. In January this year, I went to the United States again and visited the Bioengineering Department of the University of Wisconsin. I saw an unspoken mutual understanding and close cooperation among people of different branches and levels of learning (including biological science, computer, and engineering). Their work in basic research and the basic part of applied research is outstanding. New discoveries are made each week. Results of basic research can generally be turned into commodities in just a few years. Internationally, bioengineering is now in its second or third generation of development, and changes occur daily. All this depends on basic research. At the same time, basic research is opening up many new fields. In comparison, our bioengineering has only reached the level of the first generation, and we are still short of trained people in this field."

Before the end of our conversation, Professor Cao said with confidence: "The Chinese people are intelligent and hardworking. With necessary support from the state, we certainly can achieve outstanding results in scientific research. At the same time, we must constantly strengthen scientific research management in order to produce results and train qualified people quickly and accelerate the pace of reform."

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XIAN JIAOTONG UNIVERSITY'S TECHNOLOGICAL ADVANCES LISTED

Tianjin JISHU SHICHANG BAO in Chinese 25 Mar 87 p 2

[Text] To take part in the "scientific and technological achievements exhibition of 14 interior universities" to be held in Hong Kong, the Xian Jiaotong University presents some first-class technologies:

DH-Type High-Strength Light-Weight Hoisting Rings: This is an important tool for oil drilling. Made of high-strength, high-toughness, structural alloy steel, the DH series of light-weight hoisting rings are surface-hardened to further improve their fatigue property. The rings are designed and tested according to the technical standards of the American Petroleum Institute (API), and they have been recognized by the API and given the right to use the API symbol. The new type of rings weigh only one-half the weight of ordinary rings, but are far superior in tensile strength and fatigue life. They have no surface damage and are forged as one piece, making them particularly suited to oil drilling work.

Nontoxic Fast Gaseous Cyaniding Technology: This is an important technology for metal heat treatment. It is a fast and dry cyaniding process carried out by instillation in a well-shaped furnace, replacing the traditional liquid cyaniding process. The harmful substances contained in the gas discharged from the furnace are in quantities far below the national standards. Tests of the exhaust gas show: no HCN, CO, and $C_6H_5NH_2$; 2.3 mg/m^3 of NH_3 (national standard 30 mg/m^3); and 0.068-0.072 mg/m^3 of NO (national standard 5 mg/m^3).

The technology is applicable to shallow (<0.4 mm) and deep (>1.0 mm) cyaniding. The speed of the process changes with temperature. It works more than twice as fast as the kerosene + NH_3 process. It can be used for heat treatment of ordinary low-carbon steel and case-hardened alloy steel.

Mechanical Trouble Detection and Diagnosis Software Package: This computer software package serves the maintenance and repair of power plants by monitoring their mechanical conditions, discovering potential troubles in good time, and pinpointing the location of the troubles. Its main part is the mechanical trouble diagnosis software. The software package can perform the following functions: Fourier spectrum serial analysis, several time series analyses and tendency analysis, characteristics identification,

trouble recognition, equipment trouble management and report generation, axle locus display and dynamic balance test, reflection of relative axle positions in various operating modes, signal generation, statistical signal characteristics, divergence indexing, and bispectral analysis.

In addition to diagnosing mechanical troubles, this technology can also be used to make dynamic analysis of the driving chain of various types of machines in order to find the key parts which determine the driving chain's precision and thus provide the basis for product designing. It can also separate equipment vibration noise signals to help reduce both noise and vibration. The analysis method and signal generation processed used by this software package will make the work of those engaged in theoretical research easier.

Included in the package is an executive file for the owner's direct use, and a library file for the owner to make his own main programs and develop new functions. The package uses FORTRAN and DBASE languages and can be operated by the DOS system on IBM personal computers and compatible components. It has high-density screen display, printout, and man-machine interaction capabilities.

Fluid Wave Filter: Suitable for use in liquid and gaseous systems, this wave filter can maintain a smooth flow of fluid, lower pressure fluctuation, reduce vibration by fluid surges, and cut down noises. Installed in a hydraulic system, it becomes a hydraulic wave filter and ensures a steady flow of liquid through the servo valves and hydraulic cylinders. It has the following technical qualifications: As a hydraulic wave filter, it can absorb 80 to 90 percent of the pressure fluctuations, keep the pressure fluctuations on a hydraulic test bench at a level better than class B of the ISO international standard, and reduce system noise by 5 dB(A). By using the wave filter, the pressure loss is lower than 120 kPa. Used in a pneumatic system, the wave filter can greatly reduce flow and pressure fluctuations and cut down the exhaust noise of the pneumatic hammer in the system by 13 dB(A).

Pseudorandom Ultrasonic Doppler Blood Flow Meter: This is a new medical instrument for measuring blood flow in the human body. In addition to the functions of ordinary Doppler blood flow meters, this instrument can also quickly find blood vessels, determine blood flow direction and speed, determine the distance between a blood vessel and the skin surface (resolving power 1 mm) and a blood vessel's diameter, indicate blood flow speed by output of sound signals, and display and record forward and backward blood flow signals. The instrument is modulated with pseudorandom numbers and works in continuous waves. It is highly sensitive and capable of measuring blood flow in the tiny arteries in man's fingers. Its operating temperature is 10°C to 30°C. It is useful in angiosurgery, burn plastic surgery, and orthopedics.

Computer Pediatrician: This is a modern medical diagnosis tool composed of various diagnostic programs. It combines artificial intelligence, probability statistics, fuzzy mathematics, and the rich experiences of pediatric

specialists and professors. Like a doctor, the computer can ask questions about a patient's symptoms and medical history and make diagnoses. It can be used at a patient's first and subsequent visits to a doctor or hospital, write out prescriptions, propose treatment and tests, and put case records in storage for future reference. It can diagnose nearly 100 child diseases including respiratory, digestive, nervous, blood, urinary, and cardiovascular diseases and common diseases among newborn babies. It has a Chinese and an English version and can be used on IBM PC's and compatible components or Apple-II computers. It can serve as a doctor's supplementary diagnostic tool or as a family health consultant.

Pipeline Vibration Elimination Technology: This technology can eliminate vibration in pipelines caused by piston compressors and replacement pumps. By using this technology on imported or Chinese-made compressors, the pipeline's maximum amplitude (double) will be reduced from 300-1,000 μm to 20-100 μm; and on Chinese-made replacement pumps, to under 100 μm. The technology can be used on site to measure pipeline vibration, make calculations and analyses, and decide on measures to eliminate the pipeline vibration quickly and effectively. Used in designing a compressor pipeline system, the technology can ensure the pipeline's smooth operation with a maximum amplitude (double) of under 100 μm. The technology is useful to petroleum, chemical, and other industrial and mining enterprises with a lot of pipelines and pipeline vibration problems.

Strain-Type Microcurrent Sensor: Used for measuring steady and unsteady flow speed of fluids (such as gas, steam, water, and oil). Installed inside a pipe, it can measure the rate of flow. A microelectrical resistance strain element as wide as a human hair is installed on the sensor, and the dimensions of the sensing component is similar to those of a match. With a natural frequency higher than 1,000 hz, the sensor has a wide measurement range with either gas or liquid as the medium to be measured. Its operating temperature can be above 3,000°C. The technology can be used in heat-power, chemical, petroleum, hydraulic, pneumatic, and other branches of engineering.

The above-mentioned technologies are transferable. Those who are interested please contact the Scientific Research Department of Jiaotong University, Xian, Shaanxi.

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S&T REFORM HELPS TRANSFORM OLD INDUSTRIAL BASE

Beijing RENMIN RIBAO in Chinese 12 Apr 87 p 4

[Article by staff reporter Jiang Hanzhen [5592 3211 4631]]

[Text] Shenyang, a city selected for experimental reforms of the scientific and technological management system, is using the new vigor displayed by local scientific research institutes and scientists and technicians after given greater freedom to speed up the technological transformation of enterprises and bring changes to the old industrial base whose products, equipment, and technology have become obsolete, and economic performance and competitiveness are poor. "Relying on science and technology to revitalize Shenyang" has become the city's goal.

Shenyang has had a head start in reforming the scientific and technological management system, and to varying degrees scientists and technicians have been given greater freedom in work. What is to be done next? How should the reforms be intensified? In tackling tough scientific and technological problems and transforming the old Tiexi industrial district in the past year, the city has come to understand: Reform of the scientific and technological management system is not the end. The ultimate goal is to achieve better economic results. Further intensification of reforms should be coordinated with Shenyang's economic reform as a whole, so that science and technology can serve the city's revitalization.

Tiexi is an old industrial district established during the First 5-Year Plan, and a large number of big industries are crowded in here. It accounts for more than 50 percent of Shenyang's industrial output value and tax and profit revenue. Its impact is felt nationwide. However, from a development viewpoint, it is backward technologically and in products, and has a serious problem of industrial pollution. It was included last year in the regional reform plan during the Seventh 5-Year Plan period.

The Shenyang Branch of the Chinese Academy of Sciences has six research institutes and a factory, a great number of highly qualified people, and advanced research facilities. The reforms have greatly increased their enthusiasm to serve local economic development. Regarding the Shenyang CAS Branch as an important force for Shenyang's economic development and Tiexi's transformation, the municipal government has signed a long-term scientific

and technological cooperation agreement with it. Acting as a "matchmaker," the municipal government has helped form lateral ties between the CAS branch and major enterprises in Tiexi in order to transform the district's traditional industries with new technology. For this purpose, the city has formulated preferential policies to attract the research institutes under the CAS and central ministries and commissions in Shenyang to take part in solving major technological problems for Tiexi. Preferential treatment in investment and remuneration is given to those engaged in technological transfers, services, and consultations for the overall transformation of the Tiexi industrial district. At present, there are tens of thousands of scientists and technicians working in Tiexi. Interdepartmental and intertrade cooperation is developing to tackle technological problems at different levels and in different fields. Of 50 existing cooperation projects, one-third are dealing with new technologies.

The technological transformation of Tiexi represents the direction of Shenyang's reform as a whole. Many of Shenyang's enterprises have gone beyond the city to establish various forms of associations with research institutes and universities and colleges in other parts of the country. This also means new work choices for scientists and technicians elsewhere.

Tackling tough technological problems related to transformation of the old industrial base has become the main task of Shenyang's scientific and technological workers. The city's planning, economic, industrial, commercial, finance, and tax departments and defense industries are also looking for ways to support the scientific and technological research projects so that science and technology can more effectively serve Shenyang in its economic growth and in playing its multiple functions and roles as a key city.

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MISUSE OF S&T RESEARCH FUNDS NOTED

Beijing KEJI RIBAO in Chinese 28 Mar 87 p 1

[Article by the Research Project Department of the Science and Technology Bureau of the State Planning Commission: "Funds Earmarked for Scientific and Technological Research Must Be Used for Their Specified Purposes Only"]

[Text] The funds earmarked for major scientific and technological research projects during the Seventh 5-Year Plan have been made available by the State Planning Commission, the Ministry of Finance, and the project organizing and coordinating departments to the responsible departments and units.

The funds are mainly for laboratory instruments, testing equipment, information and data, professional consultations, energy consumption, material supplies, and other expenses which are absolutely necessary for the research projects. China is not rich. The funds allocated each year for scientific and technological research cannot meet all the demands, but they are the best the country can do under present conditions. For the research projects to succeed, it is essential that the funds earmarked for them are managed properly and used for the specified purposes only.

It must be pointed out that in our recent investigation of some of the projects, we found that research funds were held up, from which unauthorized "administrative expenses" and "funds" were taken, at each level in some units. For example, in some cases, 15 percent or more of the research funds were taken for "administrative expenses" at the university, college, and research institute level, and another 5 percent or so were deducted at the department level for so-called chairman's "funds," administrative "funds," and so forth. Such practices showed a lack of concern for the general interest, further reduced the already insufficient research funds, and hampered the progress of the research projects. Some units failed to exercise good judgment in using funds, spending too much money on meetings, field trips, foreign observation tours, etc., at the expense of the research projects. Therefore, it is imperative to strengthen management of research funds and make sure that money is used where it is needed most.

The responsible coordinating and management departments must enforce the relevant provisions of the state scientific and technological research management procedures for the Seventh 5-Year Plan period and firmly put an

end to the practice of holding up and misappropriating research funds. The research institutes participating in research projects should follow the principle of careful calculation and strict budgeting and cut down expenses. They should set up a sound accounting system to manage the special research funds and put an end to the practice of taking "administrative expenses" and "funds" out of research funds. The scientists and technicians too should pay attention to how research funds are being used and urge the leaders and other responsible personnel of each unit to make reasonable arrangements, cut down expenses on meetings, reduce unnecessary field trips, and, more important, firmly check the unhealthy tendency to use research funds to give dinner parties, send gifts, and indulge in extravagant eating and drinking.

In short, there are many ways to manage research funds properly, but the key lies in taking the matter seriously. Only then will it be possible to make the limited research funds produce better results.

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TIE BETWEEN TECHNOLOGICAL PROGRESS, ECONOMIC DEVELOPMENT

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENCE OF SCIENCE AND MANAGEMENT OF S&T] in Chinese No 3, Mar 87 pp 31-32

[Article by Zeng Di [2582 3321]: "Strategic Thinking on the Correlation Between Scientific and Technical Progress and Economic Development"]

[Text] Science and technology has to be oriented toward economic development, and economic development has to rely on S&T progress. This is a contradictory process of mutual dependence and interdependence. This contradictory process will spiral upward for a long time to come, propelling the forward development of society's material and spiritual civilization at an unprecedented pace.

China's science and technology and its society and economy are relatively backward. China is a vast land with a large population and little accumulated wealth in which development is also extremely uneven. Contemporary thinking, culture, and education coexist with remote antiquity, ignorance, and superstition, and advanced production forces equipped with modern science and technology exist alongside primitive production forces of slash-and-burn farming, plowing done by humans, and carrying of loads on shoulder poles. Communist ideals are jumbled together with feudal metaphysics, and a spirit of opening to the outside world with complete reform of the system is mixed together with yearning for the closed door national isolation of the old system. The aforementioned phenomena are interwoven, mutually repelling, mutually conflicting, and are both mutually advancing and mutually destructive. This is the state of the nation and the reality. For these reasons, any study of thinking about macrodecisions must give serious consideration to the state of the nation and examine all mutually contradictory, unbalanced phenomena. There must be full cognizance of these unbalanced phenomena and correct use made of these contradictions, the methods of democratic discussion and scientific analysis applied, and the techniques of comparative differentiation adopted as the only way in which to produce tremendous external pressure, internal vitality, and dynamism for reform. Modern management theory holds that strategic decisions have their origins in the following ways: 1) pressure from outside or from higher authority; 2) demands made from lower echelons or from the interrelated environment; 3) managerial personnel expectations about being able to express themselves creatively. The goal of strategic decisions is always the hope of finding a new balance.

In view of the foregoing analysis, the sequence of thinking and the trend of development that should be taken into consideration when handling the correlation between China's S&T progress and economic development are as follows;

1. Multilevel, Omnidirectional Strategic Thinking

In terms of geographical environment and regional economy, coastal cities are on a high level that combines science and technology with economics; thus they should set goals for rapidly approaching the advanced levels of developed countries. As a result of having been the focus of construction for many years, large and medium-size inland cities have a considerable concentration of S&T facilities and skilled personnel; however, they lag far behind coastal cities in economic development. For example, the relative level of higher education and S&T forces for 17 key cities in the country (in proportion to the total number of urban staff members and workers) shows the following precedence: Xian, Nanjing, Wuhan, Chengdu, Beijing, Taiyuan, Jinan, Lanzhou, Harbin, Guangzhou, Shanghai, Dalian, Chongqing, Shenyang, Tianjin, and Qingdao. Five key coastal cities are below 10th place. In 1982, S&T forces in these five cities were approximately 40 percent that of the 12 inland cities; however, the GVIO of these five cities was 118.4 percent that of the 12 cities and public revenues were 184.4 percent. This means that the contribution to economic development of S&T forces in coastal cities is 4.6 times that of inland cities. Such overall effectiveness fully reflects imbalances in regional economic development, for which there are many reasons. Large and medium-size inland cities should use the S&T forces they have accumulated over a long period of time in an effort to narrow the economic gap with coastal cities, and they will have to rely mainly on the strength they generate themselves to fill this gap. The past practice of sacrificing the interests of coastal cities for the development of inland cities can no longer persist. They will have to wait until coastal cities feel that the transfer of capital and technical forces to the interior is profitable before being able to let circumstances guide actions. This is a law of economic motion. The farflung rural villages and the hinterland are the third level. Agricultural science and applied technology will be used to take a new road of Chinese-style rural industrialization, namely, the specialization of farming, aquatic breeding and processing, and rural industrialization whereby people leave the land without leaving the countryside. The Qinghai-Xizang Plateau and frontier mountainlands are the fourth level. The imperative for development of this level is national strength and the urgent requirement for energy and materials, and only when there is large-scale mining will it be possible for some of the regions in these areas to prosper. The situation of imbalance can be solved only in the course of development.

By so-called omnidirectional is meant the establishment of some high technology industrial bases in certain picturesque inland cities. Places having airports or located fairly close to airfields that can provide superb living conditions will be able to attract foreign capital and sophisticated technology. This is because currently some high technology information industries have become superlight and miniaturized, while product production cycles are short and one product supersedes another quickly. There is no need for the communications and transportation environment of the seacoast;

instead, the emphasis is on production and a comfortable and attractive living environment. Therefore, in developed countries, geographical location is no longer the determinant for economic development.

2. Suiting of General Methods to Specific Circumstances, Gradually Making Thinking About Strategic Decisions More Concrete

So-called macrodecisions apply not only to national policies made by central authorities, but also include those made by regions and departments as well as large enterprises and certain institutions of higher learning, so long as they are departments and units whose decisions have a substantial effect on the nation's economy and culture, and its science and technology. The decisions that are made should be made primarily out of responsibility for the nation's future and not, like of those of most enterprises, primarily out of responsibility for the interests of staff members and workers, and consumers. This is because, in a commodity economy, if the interests of staff members and workers are ignored, there is no foundation for competitiveness, and if the interests of consumers are ignored, the conditions for existence are lost. But the country's tax revenue interest is the function value of the interests of both of these. Therefore, a combination of the overall interest concept for macrodecisions and the enterprise interest concept for microdecisions is a concept having two opposing aspects that are simultaneously opposite and unified. Formerly, we always emphasized the subordination of enterprises to the national interest, with the result that the state supported enterprises and enterprises supported staff members and workers, and the ones to suffer ultimately were the broad masses of consumers.

The suiting of general methods to specific circumstances and gradually deepening thinking about decisions includes the following three elements: 1) Decisions made by central authorities should be broad and not defined while decisions made by local areas and departments should be defined rather than broad. The national environment (including political, economic, cultural, scientific and technical, ethical, and price concepts as well as population, resources, local environments, meteorology, etc.) differ in each region and sector, and there are differences among regions and sectors. Decisions have to make full use of environmental advantages in setting goals; they cannot create the environment first and then decide goals. The environment can be created and changed; however, this is always a fairly long process. For example, if a change in the skilled persons environment is required, between 20 and 30 years of effort will be required. Creation of a fine ecological environment will require between 20 and 30 years of afforestation. 2) If each jurisdiction exploits its own advantages, it will certainly be unable to achieve the goals of its owns decisions within another region, much less be able to copy the thinking and methods of others. 3) Decisions made by localities and departments must guard against filling gaps, not setting priorities, and not being concerned about the environment and the desires of the majority of people, much less neglect one's own interests.

3. Stragetic Thinking About Conditions for Conversion of S&T Capabilities

Science and technology are productive forces; however, this productive force has to be scientifically organized and managed to become effective. China's

S&T conversion coefficient is one-fourth that of the United States, one-sixth that of Japan, and one-third that of the USSR. Five of China's coastal cities have a conversion rate that is 4.6-fold that of 12 inland cities.. Therefore, in the correlation of science and technology to economic development, priority must be given to a decision to study ways of raising the conversion rate, including material incentives and information incentives, and a sense of personal accomplishment for S&T personnel. Unless priority is given to study of ways to increase the conversion factor of S&T productive forces, more optimized macrodecisions will not have very great effect.

9432
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ECONOMIC BENEFITS FROM SCIENTIFIC PRIZEWINNERS EXPLORED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENCE OF SCIENCE AND MANAGEMENT OF S&T] in Chinese No 3, Mar 87 pp 22-24

[Article by Li Fumin [2621 4395 3046], Wang Yuejuan [3769 2588 1227], Zhou Lihua [0719 7787 5478], Xu Yanchun [1776 3601 2504] and Zhang Xiaoling [1728 1321 0109], Zhejiang Provincial Science and Technology Information Research Institute: "Survey and Evaluation of Economic Benefits From Investment in Science and Technology in Zhejiang Province"]

[Text] A survey of the economic results of S&T achievements is an important task in exploring the correlation between S&T progress and economic and social development to improve the management of scientific research, and it holds practical significance for promoting implementation of the policies of "reliance" and "orientation." We made a survey of benefits derived from more than 1,000 outstanding S&T achievements that received merit citations from the Zhejiang Provincial Government during the Sixth 5-Year Plan. Results of this survey show the role played in the development of production and in increasing economic benefits by the intensification of scientific research and by the promotion of S&T achievements to be remarkable in the extreme.

I. Survey Subjects and Methods

The subjects of the survey were 1,025 of the outstanding developmental and applied S&T achievements awarded prizes by the Zhejiang Provincial People's Government from 1981 through 1985, 834 of which were industrial achievements and 191 of which were agricultural achievements. Our method was a general survey, and the main components of the survey were the origin of the problem concerned and the research expenses involved; new expenses for fixed assets when the achievements were applied; indicators of the economics of technology once the results were applied and were used consistently in production; and socioeconomic benefits and scientific effectiveness.

II. Methods of Evaluating Economic Effectiveness of Investment in Science and Technology

Evaluation of the application to production of S&T achievements and their role in spurring economic development are in the process of being explored nowadays both in China and abroad; consequently, there are as yet no uniform methods

for making calculations. Nevertheless, in an overall sense, there are two basic ones. One is use of mathematical functions for production as is done in the West; the other is an item-by-item calculation of economic benefits obtained in terms of S&T progress, comparing them with expenses for each item in the process of researching and applying the S&T achievements. In view of the goals of the survey, and in consideration of possibilities for obtaining the needed data, we propose the following evaluation method using the second of the two methods.

1. Method of Evaluating Economic Benefits From Investment in Industrial S&T Achievements

In calculating direct economic benefits following the use in production of industrial S&T achievements, we stipulated the following: Increase in taxes and profits (or output value), of a user unit (usually the unit that used the technology first) after consistent use in production for 1 year serving as direct economic benefits; the sum of research expenses for the achievements, and expenses for new fixed assets by the unit applying the achievements serving as the investment in science and technology; the new additional tax and profit rates (P_B), i.e., the ratio between the new additional annual taxes and profits following use of the achievements and the investment in S&T investment in the project that produced the achievements. The reference indicator used to evaluate direct economic benefits from the achievements was the new output value rate (P_V) from investment in science and technology, i.e., the ratio between the increased annual output value following application of the achievements and the S&T investment in the project that produced the achievements.

For achievements in the category of new types of products, the added annual taxes and profits and the annual output value were the annual taxes and profits and the annual output value obtained. For achievements in the category of new types of technology, the new increase in annual taxes and products and the new annual output value was the difference between the annual taxes and profits and the annual output value for the new technology and the old technology.

2. Method of Evaluating Economic Benefits From Investment in Agricultural S&T Achievements

In evaluating economic benefits from agricultural S&T research achievements, the annual benefits obtained as of the end of 1985 in the entire area of application of the achievements were used. The evaluation criteria used for direct economic benefits from agricultural scientific and technical achievements was the net benefit rate (P_K), i.e., the ratio between annual net benefits following application of the achievements and investment in the science and technology that produced the achievements.

III. Survey Conclusions

There were 1,025 S&T achievements covered by this survey. Survey forms were filled out and returned on 666 of them, or 65 percent of the total number covered by the survey. Of these, achievements on 622 had been adopted for use

in production, the remaining 44 either not having been transferred or not having been applied to production. Now let us divide up the economic benefits obtained from investment in science and technology for only that portion of achievements that were adopted for use in production in industry and agriculture.

1. Economic Benefits From Investment in Science and Technology for Results in Industry

S&T achievements adopted for use in industrial production numbered 487, but a report could not be filed providing data on economic benefits obtained from technology for 164 of them for various reasons, including achievements not yet having reached the stage of production readiness or trial production, and turnover of achievements to other provinces. Those that had gone into production and were consistently producing, and for which a report had been filed providing data on economic benefits obtained from technology, numbered 323. Statistics on achievements from these 323 are as follows:

Actual research expenses: 11,322,600 yuan
Increase in fixed assets in units applying achievements: 25,379,600 yuan
Increased annual taxes and profits: 91,281,600 yuan
Increased annual output value: 297,490,600 yuan.

From investment in science and technology for 323 industrial achievements, the increased taxes and profit rate, P_B, was 2.49, and the increased output value rate, P_V, was 8.11. This is to say that for each yuan invested in science and technology, there was a 2.49 yuan increase in annual taxes and profits and an 8.11 yuan increase in annual output value.

2. Economic Benefits From Investment in Science and Technology for Achievements Applicable to Agriculture

A total of 135 achievements in agricultural S&T have been applied, 19 of which have not yet produced economic benefits. Statistics on economic benefits on the other 116 may be provided as follows:

Actual research expenses: 5,285,700 yuan
Increase in fixed assets when achievements applied: 6,743,100 yuan
Average annual increase in net earnings: 615,977,600 yuan.

The net economic benefit rate, P_K, from investment in the 116 agricultural S&T S&T achievements was 51.25, i.e, a net increase in earnings of 51.25 yuan for each yuan invested in science and technology.

Results of the survey show outstanding economic benefits from investment in science and technology.

IV. Economic Benefits From S&T Investment in Terms of Different Categories of S&T Achievements

Economic benefits from S&T investment for 323 industrial S&T achievements, and for 116 agricultural S&T achievements for which direct economic benefits have been calculated categorized in terms of increased annual taxes and profits and annual net earnings are as follows:

1. Classification in Terms of Size of Economic Benefits From S&T Investment

Calculation of increased taxes and profit rates, P_B, for each one of the 323 industries that applied achievements and then ranking them in terms of the size of the P_B shows 59, or 18.27 percent, to have had a P_B greater than 10, and 85, or 26.32 percent, of them to be in a range in which 10 was greater than P_B and P_B was greater than 2.49. Those with a P_B of less than 2.49 numbered 179, or 55.41 percent. Similarly, among the 116 agricultural achievements, those with a P_K greater than 500 numbered 23, or 19.83 percent, while 29, or 25 percent, were in a range in which 500 was greater than P_K and P_K was greater than 51.21. Those with a P_K of less than 51.21 numbered 64, or 55.17 percent. This shows that for S&T achievements applicable to both industry and agriculture, the main source of economic benefits from investment in science and technology is high benefit and medium benefit projects.

2. Classification in Terms of Amount of Expense for S&T Investment

Arrangement from high to low of expenses for investing, in the 323 industrial S&T achievements, I, (i.e., the sum of expenses and costs of new fixed assets) shows 27 to have had an I equal to or greater than 300,000 yuan, and an increased taxes and profits rate, P_B, from investment in science and technology of 0.90. In 89 instances, 300,000 yuan was greater than I, and I was equal to or greater than 100,000 yuan, with a P_B of 2.70. In 207 instances, I was less than 100,000 yuan for a P_B of 6.00. Similarly, when the 116 agricultural projects to which achievements were applied were arranged in order of precedence, those with an I greater than 110,000 yuan numbered 12, their net benefit rate, P_K being 2.33. Those in which 110,000 yuan was greater than I and in which I was greater than 30,000 yuan numbered 34, their P_K being 100.46. Those with an I of less than 30,000 yuan numbered 70, their P_K being 519.69.

In order to examine further the amount of benefit from investment in science and technology, we drew ascending correlation curves for cumulative added value and corresponding increased annual taxes and profits, or net benefit cumulative added value, resulting from investment in science and technology, which are shown in Figure 1 and Figure 2.

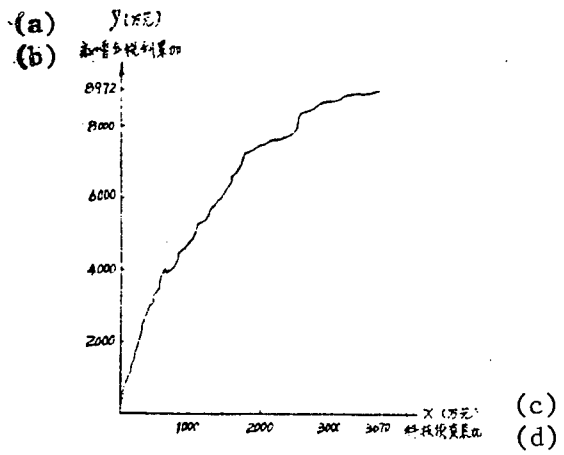

Figure 1. Correlation Between Investment in 323 Industrial Applications of S&T Achievements and Increased Annual Taxes and Profits

Key:
a) Y (10,000 yuan)
b)Cumulative increased annual taxes and profits
c) X (10,000 yuan)
d) Cumulative investment inS&T

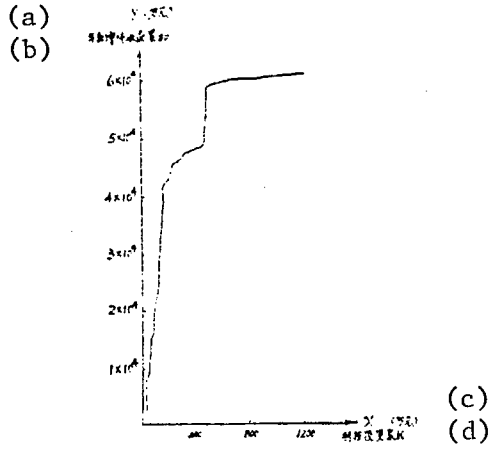

Figure 2. Correlation Between Investment in 116 Industrial Applications of S&T Achievements and Increased Annual Taxes and Profits

Key:
a) Y (10,000 yuan)
b) Cumulative increased annual taxes and profits
c) X (10,000 yuan)
d) Cumulative investment in S&T

The horizontal coordinate X and the vertical coordinate Y in the figures were determined using the following formulas:

$$Xj = \sum_{i=1}^{j} Ti \qquad \text{When} \quad Ti < Ti_{+1}, \quad j = 1, 2, \ldots\ldots No$$

$$yj = \sum_{i=1}^{j} Bi \qquad j = 1, 2, \ldots\ldots N.$$

For agriculture, N = 323; for industry, N = 116.

Figures 1 and 2 show an incremental decrease in size of benefits from investment in science and technology. This means that given the same total amount of investment, benefits are greater from small amounts of investment in many projects than from large amounts of investment in a few projects. Determination as to whether this is a generally applicable law awaits further study. Survey results show a substantial increase in fixed assets to be the cause of a large investment in science and technology. When investment in

science and technology is small, it is usually because existing production facilities are used. However, it is difficult to quantify the net value of such fixed assets; thus, they cannot be included in investment in science and technology.

3. Categorization by Increased Annual Taxes and Profits and Annual Net Benefit

Of the 323 achievements in industrial science and technology, 23 produced increased annual taxes and profits of more than 1 million yuan for an increased taxes and profit rate, P_B, of 7.24 for investment in science and technology. In 135 cases, increased annual taxes and profits were between 100,000 and 1 million yuan for a P_B of 2.37. In 165 cases, increased annual taxes and profits were less than 100,000 yuan for a P_B of 0.50. Among the 116 achievements in science and technology, 14 produced increased annual net benefits of more than 10 million yuan for a net benefit rate, or P_K, of 1,313.42 for investment in science and technology. Those showing a net benefit of between 5 million and 10 million yuan numbered seven, a P_K of 644.03. There were 42 showing an increase in net benefit of between 1 million and 5 million yuan, a P_K of 11.63. Those showing an increased annual net benefit of less than 1 million yuan numbered 53, a P_K of 6.71. Clearly, for in those instances in which the increase in annual taxes and profits or the annual net benefit was great, economic benefits from investment in science and technology were also high.

V. Discussion of Problems

1. Survey Results

Results of the survey show fairly high economic benefits from some of the S&T achievements that were awarded merit citations by Zhejiang Province during the Sixth 5-Year Plan. It should be noted, in particular, that this survey calculated direct economic benefits from industrial S&T achievements only in terms of increased taxes and profits, and output value for 1 year in the unit applying the achievements. In reality, many of the achievements have been promoted for use in many places and many units; consequently the real economic benefits derived from the application of these industrial achievements certainly exceed the results found in this survey.

The survey also found substantial differences in direct economic benefits from quite a few of the achievements. We have analyzed various reasons as accounting for these differences in economic benefits. Among the achievements applied to industry, some were affected by price policies and by social supply and demand, and some were affected by the need to control the three wastes [waste water, waste gas, and industrial residues], the need to use things in multiple ways, and the need to conserve energy. Among the achievements applied to agriculture, expenses were new fixed assets were substantial. In addition, growth cycles are long and results appear quite slowly. In some cases, economic benefits were poor, yet social benefits were very remarkable.

2. Method of Calculating Economic Benefits

The useful economic life resulting from application of various S&T achievements varies. Total benefits during the total period of useful economic life have to be taken into consideration in figuring economic benefits. However, data are lacking for determining the useful economic life of individual achievements, and benefits obtained each year during the total period of useful economic life also change. Therefore, in our calculations, we took into consideration only those economic benefits that were obtained after achievements had been used consistently in production for 1 year. Furthermore, calculation of individual economic benefits is affected by price fluctuations and is thus limited to current conditions. It was not possible in this survey to figure costs and output value in terms of comparable prices.

3. As far as methodology is concerned, the economic benefits realized are the result of the joint role of numerous factors, some of which are difficult to quantify. Even if it were possible to quantify all investment essentials, it would still be difficult to quantify accurately their individual contribution (or marginal benefit). Consequently, we maintain that the existing methods of evaluating economic benefits from investment in science and technology (including the method we have selected) are estimative to a very large extent. To suppose that the results of calculations (the ratio between P_B and P_K) represents a certain marginal benefit is not consistent with realities. As far as the significance of statistics or the significance of item evaluation is concerned, further study to perfect microevaluation methods, which holds major practical significance for future planning and management work, should be the main direction of future study of methodology.

9432
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CHARACTERISTICS OF S&T TASKS IN SEVENTH 5-YEAR PLAN REVIEWED

Tianjin JISHU SHICHANG BAO in Chinese 18 Mar 87 p 1

[Article by Dai Zongji [2071 1350 3444], of the State Economic Commission Science and Technology Bureau: "On the Characteristics of the Major Scientific and Technological Research Projects in the Seventh 5-Year Plan"]

[Text] The State Economic Commission is responsible for the coordination and implementation of more than 100 major S&T research projects during the Seventh 5-Year Plan. An appraisal of these projects has been basically completed after more than 1 year of work. More than 150 universities and colleges, more than 500 research institutes, and more than 400 enterprises have taken part in the appraisal, breaking the trade barriers in this extensive joint effort.

The major S&T research projects in the Seventh 5-Year Plan are selected and coordinated on the basis of experience gained in the Sixth 5-Year Plan. They are characterized by the following:

Streamlining Government Administration And Delegating More Power To The Lower Levels To Bring The Initiative Of Each Department Into Full Play.

The general objectives of the S&T projects in the Seventh 5-Year Plan are: to close the gap between scientific research and production and make sure that more than 80 percent of research results are translated into productive forces; to make sure that a number of S&T innovations which will bring important economic benefits will be accomplished; and in the process of tackling key S&T problems gradually form a strong S&T force with the research institutes, universities, colleges, factories, and enterprises as the backbone. For this, some necessary changes have been made to the prodecures for the examination and approval of contracts. The State Economic Commission will only examine the feasibility reports on projects to make sure that their general orientation is correct. The power to sign, examine, and approve contracts is delegated to the departments concerned.

Emphasizing That Scientific Research Must Serve Production And Striving To Turn Research Results Into Productive Forces. This is the important guiding principle for the S&T research projects in the Seventh 5-Year Plan. The State Economic Commission stresses that scientific research must be combined with the solution of key technological problems in production, capital

construction, and technological development, and that no less than 80 percent of the S&T achievements must be turned into productive forces. Accordingly, all departments must gear their S&T research projects to raising their technological standards and fulfilling their production tasks. For example, the Ministry of Petroleum Industry, acting on the State Economic Commissions' requirement, had 166 experts appraise 11 research projects in light of oilfield production and made sure that more than 80 percent of the research projects will be turned into productive forces.

Integrating S&T Research Projects With Capital Construction, Technological Transformation Of Enterprises, And Mastery And Application Of Imported Technologies. S&T research projects should serve technological transformation, capital construction, and mastery and application of imported technologies. In coordinating and implementing the S&T research projects in the Seventh 5-Year Plan, the State Economic Commission has intentionally combined the work in these different areas. For example, research projects have been combined with state and department capital construction project so that the results of research can be applied on the construction projects and increase construction speed, and S&T projects have also been combined with technological transformation and technological imports to form 12 major assimilation and absorption projects. Thus the links in S&T research will become an organic whole to serve economic development.

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SICHUAN'S S&T EXCHANGES ABROAD DEEMED SUCCESSFUL

Chengdu SICHUAN RIBAO in Chinese 16 Mar 87 p 1

[Excerpts] Sichuan's well-planned S&T interchange with foreign countries is combined with the mastery and application of imported technologies and the earning of foreign exchange from technology exports. Last year, the province earned $1.5 million in foreign exchange from such exports.

Some advanced and competitive technological achievements have already entered the international market. The State Science and Technology Commission held an exhibit of China's technological achievements in Tokyo, Japan, in May 1986. Among the 30 items on display, 9 were from Sichuan, including the Tianfu Cola, an artificial crystalline lens, extra hard cutter materials, agricultural chemical 618, a non-uniform radiator module, and so forth. The Hesheng Engineering Co of Singapore bought more than $10,000 worth of hemostatic fiber, a product from Sichuan, at the exhibit. Following the exhibit, Japanese businessmen have come to Sichuan to talk about purchases with relevant provincial departments, and letters of intent have been signed on many items.

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LEGAL ASPECTS OF MOONLIGHTING FOR S&T PERSONNEL REVIEWED

Beijing KEJI RIBAO in Chinese 23 Mar 87 p 3

[Text] At present, there is a lack of common understanding on the concept of S&T personnel holding concurrent jobs. Some maintain that a scientist or technician has concurrent job when he works for pay in his spare time. This is a broad definition. By this definition, a concurrent job can mean that a scientist or technician is hired by another organization to give lectures, do research, make designs, serve as an advisor, and so forth, or that he is using his spare time to work for himself as a professional in such fields as writing, translation, editing, independent research and designing, spare-time consulting services, and so forth. Others see concurrent jobs in a narrower sense. They maintain that a scientist or technician is considered to have a concurrent job only when he is hired by another organization to work for pay in his spare time. By this narrower definition, a scientist or technician working for himself as a professional in his spare time is not considered to hold a concurrent job.

We hold that from a strictly legal viewpoint, the narrower definition should be applied to concurrent jobs for scientists and technicians, which excludes those using their spare time to work as personal consultants or in other professional capacities for themselves. Our grounds are: 1. Concurrent jobs require special legal provisions mainly because they involve two contradictory and conflicting legal working relationships. That is why all legal provisions on concurrent jobs are meant to harmonize or handle these two relationships. When a scientist or technician uses his spare time at home to do some writing or translation or engage in personal consulting work, it may lead to property relations, but will not form another legal working relationship. There is no question of coexistence between two legal working relationships, one with his primary job and another with his concurrent job. 2. The use of spare time by scientists and technicians to engage in writing or translation work or other technical services must, of course, also be controlled and regulated by law, but that is the job of the intellectual property right law or technological contract law. There is no need to artificially put it under the jurisdiction of the law concerning concurrent jobs. To do so can only disrupt the internal logic of the legal system. 3. Judging by the existing laws concerning concurrent jobs, the legislation in most cases has adopted the narrower viewpoint. For example, article 1 of the "interim procedures for the hiring of S&T personnel for concurrent posts," enacted by the Science and

Technology Cadres Bureau in 1982, stipulates: Scientific research, educational, and medical institutions and industrial and agricultural production units may, according to their S&T requirements, hire temporary senior and middle-level S&T personnel to serve as advisors (for academic and technological guidance) or to fill teaching, lecturing, research, and other concurrent positions. Also for example, article 2 of the "provisions for S&T personnel to perform technical services or hold concurrent jobs in their sparetime," promulgated by the Qinhuangdao municipal government in August 1986, stipulates: Sparetime technical services and concurrent jobs of S&T personnel refer mainly to teaching, research, technological consultation, translation, and other similar mental labor.

We think that concurrent jobs for S&T personnel can be defined as follows: Concurrent jobs of S&T personnel are jobs they are paid to do for another organization after finishing their work in their primary assignments. Concurrent jobs include teaching, research, technological development and transfer, consulting services, contracted economic and technical work, translation, and so forth.

In this definition, three points must be noted: 1. By nature, concurrent jobs of S&T personnel are secondary to their primary assignments. 2. These secondary jobs are not assigned or appointed by the original organizations based on their own work requirements. 3. The S&T personnel get paid for their concurrent jobs.

Many scientists and technicians are now holding several positions in one unit. We think that these positions in one unit are not concurrent jobs in a legal sense. The fact that a scientist or technician is holding several position and responsible for work in several fields only shows the diversified nature of his work. It has no special legal meaning. Nor are honorary and nonpaying positions held by scientists and technicians in civic, academic, and other organizations regarded as concurrent jobs here. A concurrent job means that the scientist or technician in question has entered into a working relationship with a new unit, and that regardless of its duration, the scientist or technician always has to bear specific work responsibilities and follow specific work regulations. Holding nonpaying honorary positions in civic, academic, and other organizations does not constitute a new working relationship, and any legal consequences of holding such positions are dealt with by the relevant organization laws. Moreover, holding a concurrent job is also different from being sent to another organization on a loan basis. One organization can borrow specialized and technological personnel from another to meet its temporary requirements. A personnel loan contract must be signed by the two sides, which is legally binding. Unlike those who hold concurrent jobs, which constitute a new legal working relationship with another organization, the borrowed S&T personnel remain on their own organizations' rolls and continue to receive their wages and benefits from their own organizations.

In Practice, concurrent jobs generally fall into one of the following types.

1. Flexible type: S&T personnel with flexible work schedules can, after completing their work quotas or research contracts, take on concurrent jobs arranged flexibly to suit their needs. This type of concurrent jobs is taken

mostly by teachers of universities and colleges and research personnel who do not keep regular office hours.

2. Spare time type: S&T personnel who work regular hours can take on concurrent jobs after work or on holidays or their days off. Those known as "Sunday engineers" or "weekend engineers" are largely of this type.

3. Part-time type: This refers to S&T personnel who work for two organizations, both on a part-time basis with a mutually agreed to work schedule. This type of concurrent job is still rare in China.

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RAPID TECHNOLOGICAL DEVELOPMENT IN SHANDONG NOTED

Jinan DAZHONG RIBAO in Chinese 17 Mar 87 p 1

[Text] In the course of reforming the S&T management system and the economic system, Shandong's industrial, communications, finance, and trade departments have helped the enterprises step up their efforts in technological development. The numerous technological achievements are of high standards, producing good economic results, giving a strong impetus to the updating and upgrading of products. In 1986, the province carried out 3,089 new product and technology development projects, of which 2,161--or 73 percent--passed through technological appraisals and were put into production. Among the new technologies developed, more than 100 met the international standards of the 1970's and early 1980's; 206 filled in gaps in China; and 344 met advanced domestic standards. These figures were significantly higher than in the previous year. The technological development produced remarkable economic results. The output value of new products in Shangdong totaled 3 billion yuan in 1986, an increase of more than 500 million yuan over 1985.

In technological development, priority has been given to the assimilation and mastery of imported technologies and their application to domestic production, with initial success. Good progress has been made in the popularization of new technologies focused on the application of microcomputer technology. Gratifying results have been achieved in using microcomputers to transform the traditional industries, particularly the demonstration and pilot projects in machine tools renovation, industrial kilns and furnaces, cement, chemical fertilizers, paper-making, automobile fuel-saving, and so forth. In 1986, the Jinan No 1 Machine Tool Plant spent 200,000 yuan to renovate 67 machine tools with numerical control and digital display technologies. The renovation brought 300,000 yuan in economic returns in the first year. The popularization of microcomputer application has made rapid progress in breadth and in depth. In 1986, the number of microcomputers installed in Shandong increased by nearly 2,000 units.

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SHANXI TRIES OUT NEW CONTRACTING SYSTEM

Beijing GUANGMING RIBAO in Chinese 19 Mar 87 p 1

[Text] To encourage technological research institutes to adopt the contract system as soon as possible, Shanxi has implemented on a trial basis a new policy of "transition at once, preferential treatment for a specific period of time." Recently the provincial S&T commission conducted a survey of 15 provincial technological research institutes which made the transition to adopt the contract system last year according to the new policy. The survey showed that the policy has achieved a series of gratifying results.

Putting an end to public funding and implementing the contract system--this is the only way to reform technological research institutes. But how should public funding be ended, all at once, or over a number of years? Different departments held different views. To find an answer, the provincial S&T commission surveyed more than 20 institutes. They found that most of the institutes would be faced with difficulties if public funding was cut off all at once. But to end public funding over a number of years also posed problems. It would complicate the institutes' internal management and accounting, and it would cause problems for the institutes' overall reform. Thus, suiting measures to the actual conditions, the policy of "transition at once, preferential treatment for a fixed period of time" was adopted for trial implementation. According to the policy, 15 provincial technological research institutes would be cut off from public funds and implement the contract system at once. But, for 5 years, they would receive the following preferential treatments: 1. Under strict contract terms, the departments on top of them will give them preference in awarding contracts for research work or technical services. 2. Other conditions being equal, they will be given priority in receiving funds from the provincial S&T commission. 3. Other conditions being equal, they will be given priority in contracting for work assigned by the provincial government under the "spark" program. 4. In signing technical contracts with the provincial S&T commission, their personnel expenses will be given due consideration. Owing to these preferential treatments, the institutes have been able to maintain a certain level of income since their transition to the contract system.

Although after making the transition to the contract system, the institutes can still receive some preferential treatment from higher authorities, ultimately they must rely on their own earnings from technological contracts to meet various expenses such as wages, bonuses, and so forth. Thus the institutes are under

pressure to reform their internal management system, and various forms of realistic and practical personal responsibility systems have been established. At the same time, 70 percent of the research personnel have gone to the grassroots level to look for research projects. The total number of research projects undertaken by the 15 institutes in the past year was double that in the year before. Because the research projects selected were of a practical nature, and the research personnel knew what they were doing, 70 percent of the projects produced results in the same year, which were applied in production and produced economic benefits. In their dealings with the research institutes, some enterprises came to deeply appreciate the important role science and technology could play for them. They took the initiative to establish ties with the institutes, and research-production partnerships were formed, which further broadened the institutes' fields of activities. After public funding was cut off, the provincial metallurgy institute's leaders and research personnel negotiated a contract with the department over it to take care of all the department's research projects for the year with clearly spelled out reward and penalty provisions. After that, the institute divided its research personnel into two parts. One part worked on projects from higher levels. The other part, led by Director Wang Changmin, was further divided into five teams and headed for Wanlou, Jiaokou, Zuoquan, Jingle, and other poor mountainous areas. They entered into joint ventures with more than 10 small iron works making joint efforts to solve technical problems, or contributing shares in the form of technologies, or transferring technological achievements. More than 10 small blast furnaces, which had been out of production, were quickly put back into operation and turned into money makers for the local peasants. At the same time, the institute picked up more than 10 subjects for future research from the joint ventures. According to statistics, since the 15 research institutes made the transition to the contract system, they have in 1 year set up more than 100 partnerships of various forms and earned a total income of 14.94 million yuan, 2.54 times their past total annual operating funds. Some comrades, who had feared that the transition to the contract system would force some research institutes to close down, told the reporters: "Now people can see that this is the better way."

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BEIJING S&T WORK ENVIRONMENT IMPROVING

Beijing LIAOWANG in Chinese No 14, 6 Apr 87 pp 39-40

[Article by Huang Wei [7806 5524]: "On Creating the 'Optimum Environment' For S&T Personnel"]

[Excerpts] The Beijing Automated Technology Research Institute is trying to find new ways of reaching S&T personnel, and is creating the best conditions for them. In the past year, more than 30 of their staff have been sent to Japan to study and work. Present plans are that within the next five years all S&T personnel will have an opportunity to travel abroad to broaden their horizons and develop their abilities. One S&T staffer commented, happily, that "With the Institute caring so much about we S&T staff, we have no reason to not put out a maximum effort."

Showing solicitude and care for S&T personnel reassures them, and makes them more serious about their work. This is the correct, progressive trend now becoming common practice throughout the research institutes in Beijing. There are at present more than 14,000 S&T personnel in Beijing, the great majority of which are middle youth intellectuals trained in the new China. Seventy percent of these are in their prime years of 25 to 45 years of age. In the summer of 1986, the Municipal Science and Technology Commission made a comprehensive survey of the thinking, working and living conditions of S&T personnel in the more than 20 research institutes under the Municipality. This led them to understand that the overwhelming majority of S&T personnel are conscientious in their studies, keenly set on reform, and are boldly scaling new heights in S&T. But scientific research departments have as yet been unable to create that optimum environment for bringing out this talent. Many research units still vary in the degree to which they foster those elements which bring out positive enthusiasms. To counter this situation, during the first 10 days of last December the Municipal S&T Commission held a conference for concerned departments which dealt with governmental thought and work. The discussions produced two documents: "Some Measures For Strengthening the Spirit of Cultural Construction on the Beijing S&T Battleline," and "Regulations Concerning the Thought and Governmental Work of Scientific Research Units." To begin with, these stressed several points:

1. Create in scientific research units a governmental environmental environment which is fraternal, harmonious and progressive. Through labor unions, scholarly committees, democratic management committees, etc., exercise the

rights of personnel, caring for their vital interests, and putting their minds at ease on the job. This will lead to their enthusiastic participation in the reform of the S&T system.

2. Develop political work teams which are strong in political quality. Choose the full-time political work cadre teams from among those S&T personnel who have both considerable ability and political integrity. Departments which engage in political work should try the fixed-term office system. There are now a group of workers who have attended Beijing's Party school, with training conducted by the Political Education Department of Beijing Normal University. Annually, there will be 10 to 20 political workers sent for study at specialized political schools. The plan is that by 1990, all political workers in scientific research units under the Municipal Science and Technology Commission will receive dissimilar training, so as to attain highly specialized levels.

3. Strengthen the self-building of research teams. Build and unite among S&T personnel a new type of socialist, mutual-aid, interpersonal relationship. Promote a research ethic which has at its center dedication, innovation, realism and cooperation. Steadily formulate a research ethic which is systematic, complete and standard. Make the ethic of doing one's duty one of the criteria in promotion evaluations.

4. "Nationalize" S&T personnel management. Municipal S&T cadre offices should establish an S&T personnel management system which makes the technological dossier paramount. This means that the departments which manage S&T cadres will have responsibility for personnel management, deployment, selection, promotion and continuing education.

The Beijing Science and Technology Cadre Office has already stored in its computers the dossiers of 3,000 high-level S&T personnel, establishing a technical dossier bank of high-level talent. In 1987 they will attempt to build this data bank to include more than 300,000 middle- and high-level technical personnel. From these, they will choose 300 people who have made outstanding contributions, and then promote them form one to three grades in pay according to the size of their contributions.

If the research unit system is to be reformed, there must first be a reform of some unprofitable old viewpoints concerning the research professions, which continually are reflected in the value of S&T talent. This reform will create conditions favorable to release of this talent resources's potential. There are more than 200 staff members at the Beijing Microelectronic Technology Applied Research Institute, which was founded only two years ago. When the Institute was founded, not one fen of state investment was spent, but the Institute has now completed more than 20 research projects, several of which are now in leading positions nationally. The Institute has also accrued over 2 million yuan in economic benefits. So how does a research institute which has been in existence for so short a time make such outstanding achievements? One important reason is that the Institute has implemented a "flexible work system," which means that within a pre-arranged time personnel are not restrained by regular starting and leaving times. Instead, they can independently arrange their work time according to the needs of their work, and complete their research projects on their own. Implementation of the "flexible work system"

greatly mobilized the enthusiasms of S&T personnel. Now, the lights at the Institute often burn brightly at night, and the dining hall has S&T personnel preparing sumptuous late-night meals. The S&T staff here says that implementing the "flexible work system" has made them masters of their own time, so that they can apply themselves even more energetically to their research work, freed of pressure.

Practice has shown that, if research work is to be more successful, it is essential to foster in S&T personnel a feeling of affection for their institute and for their jobs. Do this by respecting S&T personnel's right to be in control. Draw everyone together as one, to assiduously attack key problems. The Beijing Fruit Tree Research Institute set up an institute business committee and a technology committee which had S&T personnel in charge. The institute has implemented the responsibility system, developing such reforms as an interlocking management format, with all important matters being discussed in committee. By insuring the rights of S&T personnel through this sort of organization, S&T personnel are enabled to think of themselves as the Institute's most important people, and thus assume the most important role. In recent years, this institute has assisted various counties in Beijing's suburbs to establish the foundation for improving their varieties of apples, peaches, grapes and apricots, cultivating walnuts, and other new varieties of dry and fresh fruits. So a demonstration system has begun to take shape in the Beijing suburbs for how to breed high-yield fresh and dried fruit varieties. Fruit production could reach 600 million jin during the period of the Seventh Five-year Plan, which would mean that the capital's fruit commodity supply of northern fruit would be basically self-sufficient. The glass research institute referred to earlier is also mobilizing the enthusiasms of S&T personnel. Curing the past two years they have achieved numerous successes in such areas as special glass types, optical fiber communications and crystal optics. Of these, 18 filled a national need. The Institute's technical income and the staff's annual income have both increased steadily. Last year, under conditions which were somewhat depressed, the Institute's technical income still surpassed that of the year before. Now, the research institute has not only become a major one enjoying high prestige in Beijing, it has also become an important research organization for optical materials nationally.

This is an important responsibility for research units: to show an interest in, and care for, S&T personnel, to create for them the favorable environment which will bring their enthusiasm into full play. As Zhu Yudeng [2612 5148 4098], Vice Chairman of the Beijing Municipal Science and Technology Commission has stated, in the past the management system of research units was for the people in management just "existence" or "death;" now, the reforms have led to a new trend, "managing living." The system is creating a loving, harmonious, relaxed, upward political environment for S&T personnel, so that research units will truly produce more talent and faster results. This is the chief mission of the S&T frontline spirit in cultural building in this reform period.

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CAS INSTITUTE DEVELOPS NANOSECOND PIPELINE TECHNOLOGY

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese 23 Apr 87 p 1

[Article by Lin Qi [2651 3823]: "Computing Technology Institute Achieves Breakthrough in Nanosecond PipeLine Technology"]

[Text] To develop high-speed computer technology, the Computing Technology Institute of the Chinese Academy of Sciences has produced a prototype of a high-speed pipeline, GF-10/13. With most pipelines, the design of the clock cycle is determined by the maximum delay between two stations. In this particular model, the clock cycle is entirely decided by the maximum delay differential $\{\Delta t_i\}$ max between two stations. By using a 2-nanosecond ECL circuit and cooling (fengleng), the assembly line achieves a clock cycle of 9.8 nanoseconds, a three- to fivefold improvement upon the performance under similar conditions if the traditional method is used. To exercise maximum delay-differential control over the system comprehensively, integrated design is used, from systems structure to logic design to engineering.

The GF-10/13 is made up of two pipelines--32-bit ALU and fixed point multiplication, 4 16-byte vector registers, 1 high-speed storage, and 1 controller. The largest access bandwidth in the four vector registers is 1,600 MB/S, the bandwidth of the high-speed storage is 400 MB/S. The command system has only 27 commands, which can program checkout all the parts in the machine. Special tests have been carried out on the printed circuit board in each unit. Tests were also carried out using the multiplier of 0.7-nanosecond gate delay circuit and a 5.5-nanosecond printed circuit board.

The use of the maximum delay differential design reduces the number of units deployed. The integrated design reduces critical path delay to a minimum. The scalar processing capability of the arithmetic unit is also superior to that of ordinary designs. The scalar processing time of the machine using the 36-bit addition unit of the 0.7-nanosecond gate delay circuit is 15 nanoseconds, while the scalar processing time using 32-bit fixed point multiplication unit is 50 nanoseconds. All that is slightly superior to the performance of similar units in the Cray X-MP supercomputer (24-bit addition, 19 nanoseconds, 24-bit multiplication, 57 nanoseconds.)

Using mainly the 2-nanosecond gate delay circuit, the clock cycle of the entire machine has closed in on the performance of the Cray X-MP supercomputer at 9.5 nanoseconds. When it uses the 0.7-nanosecond gate delay circuit totally, it will do even better.

12581
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ENGLISH-CHINESE TRANSLATION SOFTWARE DEVELOPED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese 23 Apr 87 p 1

[Text] "Scientific Translation 1," a machine translation system developed by the Military Science Academy, passed evaluation on 30 March.

"Scientific Translation 1" is a practical language-processing system whose goal is automatic English-Chinese translation. It is capable of turning the text of an entire English passage, including headings, into Chinese automatically. It is also capable of allowing the user to set up his own specialized vocabulary, generate and edit a human-oriented computerized English-Chinese dictionary, analyze the dynamics of the English language, and so on. The system comprises three parts: a translation system, a translation support system, and the document input-output and processing system. It is written in COBOL and contains about 50 subroutines and 5000 lines. The software requires a machine with 1Mb of internal memory and occupies 6 Mb of hard disk memory. It uses SCOMT, an innovative language special to machine translation which turns the rules of language processing into data and which becomes part of the knowledge base, thereby separating the knowledge base from the inference procedure. At present the system has a dictionary capacity of 22,000 words, of which 4,000 are phrases. The dictionary covers a wide area and the entries are selected with great precision and appropriateness. It also includes a comprehensive range of word uses and their more usual meanings. The system provides users with a good deal of supervisory, flexible, and convenient service software. It can run on three different types of machines: the UV-68, Great Wall 0520 C-H, and F-38. The speed of translation varies from machine to machine, from a high of 3,000 words to a low of 1,000 words per hour. The evaluation commission believes that it has reached an advanced standard both at home and abroad. Following evaluation, it will be sent to software production departments for commercial development.

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OEM AGREEMENT SIGNED WITH DATA GENERAL CORPORATION

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese 23 Apr 87 p 2

[Text] The Electronics Department of the New York China Trade Center [NYCTC] signed an original equipment manufacturer [OEM] agreement with Data General Corporation of the United States on 13 February 1987.

Under the agreement, the Stanford branch of the Electronics Department of the NYCTC will serve as Data General's OEM. Data General will supply the department at NYCTC with computer systems and external devices at preferential, that is, OEM, prices.

The Stanford branch of NYCTC is an organization combining trade with technology. It will be involved in the redevelopment of software and hardware on Data General machines.

The agreement also stipulates that the Electronics Department may market in the United States, Asia, and China Data General's computer systems as well as software and hardware developed on Data General machines.

The Electronics Department of NYCTC is an overseas branch of the China National Electronics Import and Export Corporation. It is a U.S. company with the status of a legal entity.

To Data General, the conclusion of the OEM agreement with NYCTC will help expand the corporation's influence in China and boost the sales of its machines on the Chinese market. For its part, the Electronics Department believes that cultivating direct relations with manufacturers is a way to obtain full technical support from them. It will also help it keep track of technology at home and provide the large number of Data General users in China with better after-sale services.

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MAPPER-1C MICROCOMPUTER ASSEMBLY JOINT VENTURE

Beijing CHINA COMPUTERWORLD in Chinese 23 Apr 87 p 2

[Article by Wen Xianli [3306 2009 4539]: "Unisys Builds a Joint Venture in Wuxi"]

[Text] The Unisys Corporation of the United States has set up a joint venture in Wuxi, Jiangsu, that will specialize in the production of the Mapper-1C three-user microcomputer system. Its Chinese partners in the joint venture are China International Trust and Investment Corporation, China Computing Technology Service Company, and Wuxi Electronic Computer Plant. The first batch of 30 microcomputer has arrived at Wuxi.

Mapper-1C is a three-user Chinese microcomputer system specially designed for the Chinese market. Besides the original capabilities of the Mapper system, it has four other ordering capabilities and five ways of inputing Chinese characters. Its most distinctive features are the Mapper board and Mapper software. Its CPU uses MC68010. On the board is a virtual memory control unit and 512 KB memory. When Mapper-1C is not running MAPPER software, MS-DOS can use this memory.

The Mapper circuit board can also be used on IBM PC/XT and other IBM-compatible machines, giving them the capabilities similar to those of the Mapper-1C.

Thus far Mapper software is the software closest to human languages. It uses the design idea of the filing cabinet to receive management data. A user can organize and process data in the form he wants, operate, and write reports without having to learn complex data structures or programming. Also, reports can be stored as standard ASCII documents or inserted into the word processing software package so popular nowadays. Alternatively, they can be treated as DIF documents and analyzed using Lotus 1-2-3 spreadsheet.

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CURRENT STATUS OF, PROSPECTS FOR TECHNOLOGY MARKETS

Tianjin JISHU SHICHANG BAO in Chinese 11 Apr 87 p 1

[Article by Zheng Daping [6774 1129 1627] and Wu Zhaohua [0702 0340 5478]: "Reasons for the Current Lull in Technical Markets and Ways to Enliven Them"]

[Text] Technical markets everywhere suffered a downturn briefly some time ago. Sales were flat in some regular markets and even slipped in others. They have improved recently, but some problems still remain. As far as buyers, mainly production enterprises, are concerned, the trouble is that their managerial relationship with the state remains a "paternalistic" one. Large and medium-sized state owned enterprises, in particular, have not freed themselves from "soft budgetary restraint." Yet enterprises, especially large and medium-sized ones, are the main players in the technical markets. From the perspective of the sellers, primarily scientific research units, institutions of higher education, and military industrial enterprises, state-owned large and medium-sized enterprises have basically not broken the habit of "eating off the common rice pot." The initiative of scientific and technical personnel has not been fully mobilized.

Specifically, buyer enterprises bear a heavy tax burden, get to keep little profits, and have limited autonomy or self-development capabilities. The "tenure system" of enterprise leaders and the enterprise "contract" system in effect induce myopic conduct on the part of enterprises. The lead time technology requires to make a difference and the risks attendant upon investing in new products fills state-owned enterprises, already strapped for funds, with misgivings about applying new technology and new products. The policy of developing new products fails to integrate production, supply, and marketing into a coherent whole, which makes it unattractive to enterprises. Large and medium-sized enterprises have more ample resources, but owing to the absence of sound new product development policies, they end up doing what small enterprises do--turning out popular, hence safe, merchandise of dependable quality, and vying with their smaller counterparts for markets. A majority of enterprises still lack the ability to absorb and assimilate technology and innovate. Many do not have scientific research sections or offices. Even when such units exist, they often do not live up to their name. There is an acute shortage of technical personnel, while the number of people actually engaged in direct research and development [R&D] is even smaller. Many enterprises count scientific and technical personnel as non-production

personnel, paying them smaller bonuses than workers, and even turn over their material rewards to the company. Intellectuals lack any enthusiasm to adopt new technology and develop new products. The fact that consumption is narrowly concentrated also affects the eagerness of enterprises to develop new products.

Let us take a closer look at the sellers' situation. Essentially scientific research institutions still "eat out of the common rice pot," with the bulk of them depending on state grants and free from any pressures to develop new technology or products. For years they have been conditioned into valuing theory and belittling application, emphasizing research and neglecting dissemination, stressing the publication of papers and ignoring the development of problem-solving skills. Private scientific research organizations are provided with neither adequate government support nor legal protection. As a result, they are slow to develop. Our reserve of new technology is nearing exhaustion and is not being replenished. There is a dearth of applicable technology, but there are also technological commodities on the technical market that are unsalable. The shortage of economic and technical consulting organizations has also slowed down the conversion of technical achievements into productive forces.

Moreover, the development of certain intermediate institutions is ridden with problems. For instance, the nature of intermediate organizations has never been defined in any policy. Their incomes are meager and some have incurred serious losses. The failure to sort out the professional and technical positions of managerial, technical, and trade personnel has undermined the stability of the scientific and technical corps in intermediate organizations. This problem too has affected the development of technical markets.

Apparently the development of technical markets is subject to and influenced by a wide range of interrelated factors. Thus we must tackle some of the major ones conscientiously in order to find a solution.

First, we must further economic and scientific structural reforms, coordinate the two sets of reforms so that they proceed in tandem and boost the development of technical markets in a fundamental way. As far as scientific structural reform is concerned, we must accelerate the overhaul of scientific research institutions. We must gradually replace the operating-fund system in some with a compensatory contract system and adopt state lending in one institution, set up a science fund in another, and institute a system of operating-expenses responsibility in yet another, depending on their individual characteristics, in order to steer scientific research in the direction of industry, thereby promoting the growth of technical markets. Turning to the reform of the economic system, we must continue to reform the enterprise ownership system by introducing a stockholding system, asset management responsibility system, and other changes. Enterprises must be impelled to demand technical progress and increase their need for new technology in order to spur the development of technical markets.

Second, we must formulate a series of policies conducive to the development of new technology and new products and institute preferential measures in the entire process, from research and development to sale and marketing.

Currently only new products that fill gaps in the nation's technology enjoy tax abatement or exemption. This is unfavorable to the development of new products and technology. The state should relax its demands on new products, lengthen the duration of tax breaks as appropriate, and set up a new technology and new product development fund. Along with the development of new products, new technical markets should be developed. Enterprises should be required to replace technology and equipment by a certain date in order to streamline the development of new products and new technology.

Third, a sound talent circulation policy should be drawn up to fully unleash the initiative of scientific and technical personnel and strengthen the development of economic, technical, and other forms of consulting services. The dissemination of new technology is more than the transfer of technical achievements. It also involves the mobility of qualified personnel. In applying new technology, a unit usually takes some risks. Therefore it is necessary for it to go through a series of procedures--expert evaluation, market forecasting, and survey--before it decides to purchase a technical commodity. This creates a need for economic and technical consulting organizations. All of that has a positive effect on the development of technical markets.

Fourth, lateral economic associations must be further strengthened. The government should step up leadership, strongly advocate the use of technology as shares, and promote technical markets by encouraging the practices of hiring technical personnel and leasing or transferring technical equipment. Publicity about the commercialization of technology should also be intensified.

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RAPID DEVELOPMENT IN FIBER OPTICS COMMUNICATIONS

Beijing KEJI RIBAO in Chinese 14 Apr 87 p 1

[Article by Wang Zhendong [3076 6966 2639]: "Fiber Optics Information Network Completed in Sichuan"]

[Text] A fiber optics information network was completed in Yongchuan County, Sichuan Province, recently, yet another national specialized technology information network planned and built by the Ministry of Electronics Industry.

Thus far the latest information network has 85 members, all units in 12 ministries and commissions, making it one of the larger integrated inter-regional, and inter-sector organizations in technical information. It is an authoritative professional organization that combines teaching, scientific research, production, and application under one roof.

Touted as the "cutting edge of communications technology," fiber optics is the most advanced, most promising communications technology in the world today. China's entry into fiber optics research is quite recent, but a good deal of progress has been made. At present as many as 52 research institutions and factories and 30 institutions of higher education are engaged in research and development [R&D] in this field, forming the rudiments of a theoretical research corps and development and production base on a par with those in developed nations. Not only does China have a practically applicable fiber optics communications system, the $8^{M}b/_{s}$ ~ 34 $M^{b}/_{s}$ system, but the Beijing Telecommunications Institute and Wuhan Telecommunications Institute have been conducting tests on two separate transmission systems with a speed as high as 400 and 560 $M_{b/s}$, respectively. The completion of the "fiber optics communications specialized information network" will have a far-reaching impact on the modernization of China's communications and go a long way toward accelerating its fiber optics research to enable it to catch up with and overtake the world's leaders.

12581
CSO: 4008/50

SHENZHEN WILL HOST TECHNOLOGY FAIR IN OCTOBER '87

HK200326 Beijing CHINA DAILY in English 19 May 87 p 2

[By staff reporter]

[Text] Shenzhen--A large Sino-foreign fair for economic and technological co-operation and trade is to be held in Shenzhen, China's biggest Special Economic Zone designated for foreign investment, from October 20 to 25 this year.

Businessmen from 500 foreign enterprises and corporations will be invited to meet their Chinese counterparts on project co-operation and business exchanges, an official of the Shenzhen Municipal Government told CHINA DAILY.

Qu Hua, the government's Vice-Secretary-General said the fair would serve as a "bridge" linking inland provinces with the outside world.

Foreign enterprises and corporations invited to the fair come from a wide area, including the United States, Canada, Europe, Japan, the Middle East, Hong Kong and Macao.

So far, 24 provinces and municipalities have agreed to send delegations which would include their largest enterprises with projects already in hand, Qu said.

Shenzhen alone has prepared 147 projects for prospective co-operation, which include the production of bicycle components, zinc-plating and tin-plating, glass fibre, engineering plastics, and automobile parts.

The fair will deal with electronics, textiles, machinery, medicines and medical equipment, building materials and chemicals.

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CSO: 4010/55

SHANGHAI ORGANIZES SCIENCE POPULARIZATION GROUPS

OW311156 Beijing XINHUA in English 1125 GMT 31 May 87

["News Feature: Scientific Knowledge Reaches Ordinary Shanghai Families"--XINHUA headline]

[Text] Shanghai, May 31 (XINHUA)--Wang Yichuan, an associate professor at the Shanghai-based East China Teachers University, lectured a few days ago on how to create a coordinated family life in a residential area.

Most of the attendants that day were retired workers and housewives.

His lecture touched on the influence between family life and members' health. The lecture drew the attention of several hundred listeners.

This was the 100th lecture on science organized by the Rongfu residential community in China's largest industrial center.

In the community, most of the 5,000 residents are ordinary workers, and few people above 60 years old have had any education.

However, "greatly improved living conditions and a rather low level of education have resulted in many family disputes and neighborhood quarrels," a Rongfu neighborhood committee member said.

In Hongzhen Street, some residents migrated from northern Jiangsu Province before the founding of new China in 1949. They brought with them some superstitious beliefs. For example, they believed that empty wine bottles could be used as "symbols of cannons to drive away evil influences." Some families put empty bottles before their doors with the bottle necks pointing at their neighbors' houses.

As a counter-measure, the neighbors hung mirrors over their doors to "reflect the evil influences back."

To deal with the situation, the neighborhood committee organized residents to learn about science to help them understand that such superstitions are futile.

Nowadays, the empty bottles are nowhere to be seen and the local people say that good fortune depends on their own efforts and the country's prosperity.

So far, more than 30 streets have set up science popularization associations in the past two years, and such associations are expected to be common among most of Shanghai's 139 districts in the next couple of years, a local official said.

These mass organizations run by neighborhood committees and retired scientists, technicians and workers usually help residents learn about science by organizing lectures, erecting displays, holding science fairs and showing documentary films.

For example, since it began holding science lectures once a month eight years ago, the Rongfu neighborhood committee has invited many teachers, medical workers and technicians to lecture on subjects from space exploration to basic knowledge about child nursing, health care for the aged, nutrition and the operation of household electrical appliances.

In the community lives a retired worker, Xie Wenhua. He had a very bad temper in the past and quarreled with neighbors, which earned him the nickname, "Cannon."

After attending science lectures, Xie, who suffers from high blood pressure, learnt that his bad temper might affect his health. Then, he began taking part in some proper physical exercises and gradually remoulded his outlook.

In Xiaochemen Street, 108 young mothers and 17 newly-married couples were offered special lectures on family life, and similar special classes are available for the aged.

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CSO: 4010/55

NPC DELEGATES DISCUSS LAW TO PROMOTE S&T

OW131522 Beijing XINHUA in English 1352 GMT 13 Jun 87

[Text] Beijing, June 13 (XINHUA)--The development of China's science and technology will be greatly promoted, the commercialization of research achievements accelerated and the development of technology markets guaranteed by law, should the technological contract law (draft) which has been submitted to the Standing Committee of the National People Congress (NPC) receive approval.

This viewpoint is generally shared in the group discussions of the 21st session of the Sixth NPC Standing Committee, which is now under way here.

Members of the congress held that the revised draft law was basically complete and mature. They proposed the approval of the law.

Members of the congress held that further articles defining the draft law more clearly should be made involving such contents as encouraging the initiative of research units and scientific personnel for inventions and creations, application of research achievements, prevention of illegal monopoly of technology and enhancing the management of technological markets, among others.

Duan Suquan, member of the NPC Standing Committee, said that inventors should not only be given honors and political encouragement but also liberal material rewards. It would also encourage them to have their names attached to their inventions.

Nonvoting delegates from Shaanxi and Shanxi provinces, and the Xinjiang Uygur and Inner Mongolia autonomous regions said that, besides laws pertaining to the scientific and technological field, regulations were also needed in agriculture, animal husbandry, fisheries and forestry.

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CSO: 4010/55

HIGH-TECH COMPANIES OF 'SILICON VILLAGE' HIGHLIGHTED

HK290916 Beijing CHINA DAILY (BUSINESS WEEKLY SUPPLEMENT) in English 29 Jun 87 pp 1, 4

[Article by Li Xiguang and Liu Ying]

[Text] A 20-minute drive from downtown to northwest Beijing will take you to a district known as Science Town, home of numerous research institutes and universities.

Thirty years ago, this Zhongguancun area in the suburbs of Beijing was bleak farmland dotted by dozens of farmhouses and tomb mounds.

Today, it has become the most developed area of high technology in China, a Silicon Village where many of China's computer companies are concentrated.

A total of 50,000 residents live and work in about 100 research institutes and high-tech companies under the Chinese Academy of Sciences (CAS).

About 2,000 scientists are engaged in the exploitation of high technology in these new firms. It is with the brains of these scientists that Silicon Village has grown into China's chief supplier of electronic products vital to the modernization programme.

Since the summer of 1983, over 2,000 research fellows and professors have left their ivory towers and shifted their efforts from pure research in laboratories to the development of technology and products.

With in the past year, over 100 shop signs for high-tech companies of various forms have appeared in Silicon Village.

In 1986 the 43 high-tech companies under CAS earned a profit of 12 million yuan from sales of their products and nearly 6 million yuan from the transfer of technology.

In all they have transferred 400 items of technology to manufacturers and had an income of 40 million yuan.

However, these firms cannot survive merely on the transfer of know-how, due to the cheap price of technology in China.

"They must sell their own products," said Liu Kun, an official of the Academy of Sciences.

So the 43 high-tech companies began to sell their products directly to their customers, turning themselves into scientific businesses.

The appearance of these scientific businessmen brought youthful vigor to once-closed academic circles.

Almost all the companies in Silicon Village are of modest size. The largest has about 100 employees, while the smallest has only a dozen. Most scientists working there are recent college graduates in their late 20s and early 30s.

Some of the companies are owned by the academy's institutes, and others are owned directly by the academy. Some are even owned collectively by the scientists or jointly by the local government and the institute.

Last year the combined income tax of all high-tech firms in the area reached 150 million yuan. This year they are expected to pay the state a total tax of 250 million yuan.

Though these firms differe in form, they have one thing in common. They don't need government financial help to develop. They are responsible for their own profit and loss. They have thus broken the practice of "eating from one big pot."

Usually China's scientific research organizations are state supported institutions. Research projects are assigned to research fellows arbitrarily. Most research scientists work in the nation's 1,005 institutes. And it has not been easy to turn their scientific achievements into products.

At the beginning, people thought scientific entrepreneurship would be short-lived.

"We didn't start our company acting on impulse. We wanted to find a place for young scientists to do research projects more freely, without over-control from the top, and to strengthen collaboration among researchers," said Tu Yan, president of the Keli High-tech Company, one of the earliest firms in Silicon Village.

"To run a company is entirely different from the pure science work I used to do," said Tu, who used to do theoretical research in acoustics. "It is much more difficult than writing research papers. We have to investigate the markets, collect feedback from our users and try to satisfy customers of various kinds."

Compared to workers in research institutes, staff members at the companies show more solidarity and identify themselves more with their firms.

"Everyone in our company is a master as well as an ordinary staff member," he said. "Here we have common interests and can seek self-fulfillment."

All research scientists in these firms also act as salesmen in turn. "In this way, we can better understand the demands of our users and improve our products," Tu said.

"The emergence of these high-tech firms may be seen as the seed and embryo of China's high-technology industry," Liu Kun, the CAS official, said after he concluded a recent survey of Zhongguancun and other scientific centres in other parts of China.

Liu's studies showed that throughout China there are now 81 licensed corporations, 58 joint ventures with industrial departments and six joint ventures with overseas enterprises under the academy.

One of the biggest firms under the direct leadership of CAS is the Keli Company, whose data collection, analysis and processing systems are now widely used in China's industries, research institutes and universities. Such products have brought a sales turnover of 30 million yuan in the last two years.

Of the 50 firms run independently by the institutes, the company under the Computer Institute is one that has expanded fastest. Its business volume topped 10 million yuan last year.

Some of these institute-owned firms have only a dozen employees whose main business is to sell the technology created by their institutes.

"With the inventive brains of the institutes, these firms have become a bridge between research and industry," Liu said.

Most CAS companies are concentrated in industrial and coastal cities like Beijing, Nanjing, Shanghai, Wuhan and Guangzhou. A survey of 59 such firms showed that 16 were related to technology, seven to chemistry, 12 to mathematics and physics, 14 to biology, 10 to geology and geography and seven to other fields.

"This indicates that every field of science has its potential for research development and doing business," said Liu.

For example, the company under the Chemistry Institute developed a sophisticated chemical coolant. In 1986 the firm sold 520 tons of it to 60 factories in China, which resulted in an immediate economic benefit of nearly 100 million yuan for the factories.

The company under the Institute of Materials Structure developed 24 types of crystals in the past two years and exported 12, which earned it $500,000 last year.

In addition to those firms attached directly to CAS and its 120 institutes throughout the country, there are also the companies run jointly by the academy and local governments or industries.

The Shenzhen Science-Industry District Company, which was set up jointly by CAS and the Shenzhen municipal government, each putting up seed money of 10 million yuan, has persuaded many international economic scientific and financial organizations to establish export-oriented high-tech industries in the district. "It will change the traditional export pattern of China's products," Liu remarked.

CAS also opened six joint ventures with overseas businesses. The Technology Promotion Centre set up with technology provided by the Institute of Zoology and with funds from a Hong Kong firm has made HK$240,000 since it started production of pesticides only a month ago.

"The switch from pure research has proved a success for the academy," Liu said. "Our next step is to let these companies gradually become research and development enterprises independent of their institutes and responsible for their own product and sales."

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CSO: 4010/58

SCIENCE, TECHNOLOGY CENTER COMPLETED IN BEIJING

OW011734 Beijing XINHUA in English 1500 GMT 1 Jul 87

[Text] Beijing, 1 Jul (XINHUA)--The China Information Center of Science and Technology, believed to be the biggest of its kind in Asia, has been completed.

The construction of the center, which passed state tests yesterday, began in September 1984. It is lcoated in western Beijing and covers more than 60,000 square meters of floor space.

The information center offers facilities for 1,500 people at the same time.

It offers reading, computer, information studies, and visual and audio materials services.

The center has more than 30 reading rooms providing self-service and individual research rooms.

It can store 4 million copies of books and materials, and its large computer center has Chinese character information processing systems.

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CSO: 4010/58

BRIEFS

NEW CAS FIELD ESTABLISHED--The Chinese Academy of Sciences currently has five fields of learning for physics and mathematics, chemistry, biology, earth sciences, and the technical sciences. Some people term these hard sciences, the term soft sciences being used to denote fields of learning having to do with modern management and scientific study of the economics of technology, such as scientists [as published] and systems engineering. Since laboratory facilities do not have to be set up for the soft sciences, the amount of investment required is small for large benefits. As a result of the application of scientific management used in the hard sciences, the soft sciences are a field of learning in which the efficiency of scientific research has been increased and that better brings to bear its enormous role in society. Consequently, it has attracted extremely great attention from leaders in the S&T field and among workers in the hard sciences. The State Science and Techology Commission and the Chinese Academy of Sciences have established relevant teams to prepare for the establishment of a soft sciences field of learning as the academy's sixth field of learning. [Text] [Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENCE OF SCIENCE AND MANAGEMENT OF SCIENCE AND TECHNOLOGY] in Chinese No 3, Mar 87 p 46] 9432

WINCHESTER DISK ASSEMBLY LINE--Shanghai Huangpu Instrument Plant has imported key equipment and technology from West Germany to build a production line to manufacture 5.25-inch Winchester disk drives. The trial products are of a good quality, perform satisfactorily, and match the technical standards of similar products overseas. The assembly line was completed and delivered on 1 April. The assembly line is capable of producing 5,000 units annually. At present its main output is the 5.25-inch 20-MB Winchester disk drive, which is compatible with the 0520 and 0530 series of microprocessors. It performs satisfactorily and there is a large potential market. Huangpu Instrument Plant is in the process of increasing the domestic content of the product; more than 50 percent of the components are now made in China. [Text] [Beijing JISUANJI [CHINA COMPUTERWORLD] in Chinese 23 Apr 87 p 2] 12581

CSO: 4008/50

SHIPPING RESEARCH INSTITUTE'S 35TH ANNIVERSARY NOTED

Beijing JIANCHUAN ZHISHI [NAVAL & MERCHANT SHIPS] in Chinese No 3, 8 Mar 87 pp 4-5

[Article by Lin Yujie [2651 5940 2638]: "Forward Developments At the No 708 Research Institute"]

[Excerpts] On 29 November 1986, on the bank of Shanghai's Huangpu River, the China Shipping Industry Corporation's No 708 Research Institute held ceremonies commemorating the 35th anniversary of its founding.

Research Institute No 708 was founded on 29 November 1950. At that time it was just a design agency, with a staff of 26. It was the first ship design organization in the PRC, and through its 35 years of development has now become a ship and ocean engineering design research organization with a great reputation both here and abroad.

Research Institute No 708 now has more than 1,800 staff members, and more than 1,000 of these are high and medium level personnel. In this research team, there are talented people who received their education prior to Liberation, as well as those who came out of school in the 1950s, 1960s, 1970s, and 1980s. There has been an abundance of talent accrued during these five decades. With so much experience, the research team has been able to assume a variety of shipping and ocean engineering total research design projects, with great results. Among these there is no lack of outstanding, excellent talent, and many of these personnel have been awarded the Shanghai Municipal Advanced collective Honor Award. Hua Yi [5478 1837], representative of middle-aged intellectuals, Shanghai's outstanding Communist Party member, and hovercraft expert, worked here while he was living.

In order to meet S&T developmental needs, and raise the standard of S&T, the Institute these past several years has sent more than 140 groups and more than 260 individuals to 23 foreign nations to observe, study and work. At the same time, they are also broadening their contacts by receiving foreign experts from various nations, holding discussions and comparing notes from their scholarly experience in naval and ocean engineering. They are learning from others to improve their weak points, and speed up the technical process.

Today, Institute No 708 is a consummate research and design organization. Its research and testing facilities are complete, and it is a member of the

international ship model testing pool. There are offices in the Institute for military assistance, design research, cargo and survey vehicle design research, ocean engineering and engineering ship design research, hovercraft design research, comprehensive testing research, construction design, information research, a computer facility and a testing and machining plant. The main testing facilities are: a ship model towing pool; a storm current pool; operational pool and special machinery; electrical, refrigeration, ventilation and demagnitizing laboratories, etc. The computer facility has two U.S.-made IBM-3031 electronic computers, with internal storage capacities of 2 and 4 million, among the optimum functioning large computers in the Chinese ship-building industry. Institute No 708 has become a total entity, with the capacity to go from research and development through the entire process up to merchandizing. This is its unique characteristic, as well as its strength.

Linking Military and Civilian Results

Throughout the course of its 35 year history, Research Institute No 708 has inseparably linked the needs of the national economy with those of building the national defense. At the same time, it has aimed at world standards for naval vessels and marine engineering, undaunted by hardship, with the courage to forge ahead. Its research design results have been obvious, with over 700 models of naval vessels and marine engineering products, nearly 500 products turned over to application, of which 250 have gone into batch production. The products researched and designed at the Institute have been for both military and foreign trade applications, exported to more than 10 foreign nations. This has given the Chinese ship-building industry a great reputation in the international ship-building and shipping communities. Among these products there are 150 which have been honored with, respectively, the national-level S&T Progress Award, the National Invention Award, the China Science and Technology Association Award and the Departmental-Municipal Level S&T Achievement Award. A selection of these follow for the reader.

The "Visionary" Spaceflight Comprehensive Surveying Vessel

This ship is of the 20,000-ton class, built in 1978, used chiefly for surveys done in connection with rocket tests on sea ranges, e.g., tracking the trajectories of submarines' undersea carrier rocket firings, the orbits of earth satellites and spacecraft, etc. The shipboard equipment is advanced, and the ship has been praised as a "floating science city." At present, only the United States, the Soviet Union and France have ships of this type which are as advanced. The "Visionary" has made five South Pacific cruises, as part of long-range rocket and synchronous fixed-point communications satellite firing missions. The ship has been awarded the National Technological Progress Award, Special Class.

The "Sunny Red" No 10 Oceanic Comprehensive Surveying Vessel

This ship is of the 10-ton class, built in 1978. It is responsible chiefly for three important missions: ocean surveying, atmospheric measurements and communications. The surveying and communications equipment on board is the most advanced, while the meteorological system is in scale comparable to that of an

observatory in a major city. It is called the "floating meterological station." This ship has participated in long-range carrier rocket firings in the South Pacific, and has functioned successfully as the lead ship in the South Pole exploration. It was awarded the National Technological Progress Award, Special Class.

The J121 Ocean-Going Salvage and Rescue Ship

This ship is of the 10,000-ton class, built in 1979. It is a multi-purpose salvage and rescue large-scale operational vessel. It is a "floating salvage center," capable of effectively carrying out rescue and salvage missions, through the use of helicopters, diving bells and deep water lifeboats, for ships damaged at sea or submarines involved in underwater accidents. Along with "Sunny Red" No 10 it successfully acted as lead ship in the South Pole exploration. Its sister ship, the J302 ocean-going salvage and rescue ship, participated in the long-range carrier rocket test-firing in the South Pacific, successfully retrieving the rocket's placement data module. This type of ship was awarded the National Technological Progress Award, First Class.

"Bohai No 1" Self-Elevating Drilling Platform

This was the first self-elevating drilling platform designed and built in China. It was built in 1972, and successfully filled a gap in China's development of well-drilling platforms. In operations in the Bohai Bay it was tested by a storm of force 10 magnitude and by the Tangshan earthquake. This platform was awarded the China Science and Technology Association's Award of Merit.

"Probe No 3" Semisubmersible Drilling Platform

This platform is of the 20,000-ton class, built in 1984. This was the first large-scale advanced drilling platform designed and built in China. It has been tested by winds of force 11 magnitude, and by waves of force 8, so its performance is proven and it s equipment reliable, demonstrating that the level of development of ocean platforms in China has stepped into the world's advanced ranks. When it was searching in the East China Sea, it drilled a well 50,000 meters deep, setting a new Chinese record for offshore drilling depth. The platform has been awarded the National Technological Progress Award, First Class, and the Special Class Award of the China Shipping Industry Corporation.

Shallow Draft 10,000-Ton Cargo Ship

This was the first generation of shallow draft cargo ships of the 10,000-ton class, economy model bulk freighters, to be developed and manufactured in China. It was built in 1984. It has some excellent characteristics: shallow draft, large tonnage, small main engine ratio and high economic benefits. It can be used for transport on river or ocean, and in the dry season can enter the lower reaches of the Changjiang River. For domestic initiative, it was awarded the National Technological Progress Award, Second Class.

"Post and Telecommunications No 1" Cable Ship

This ship was built in 1976 to carry out the Sino-Japanese submarine cable construction agreement. Design and manufacture were completed in advance of schedule, and the cable-laying project was completed successfully on time. This ship has excellent capabilities, which were commented on favorably by the Japanese side, winning honors for this country. It was awarded the China Science and Technology Association's Achievement Award, and the Shanghai Major Achievement Award.

Developing Forward, Scaling the Heights

Reform of the S&T system carried with it the impetus for Research Institute No 708 to gear itself to economic construction. This stimulated the institute's own developmental spirit. Since 1985, Institute 708 undertook vigorous reforms, implemented a compensation contract system, and became a totally self-supporting experimental unit. It formulated and put into effect a reform program of "Simplify governance, delegate authority; a small institute with large laboratories; two classes of accounting."

It has also been unshakeable in its implementation of a management policy which "concentrates on ship and ocean engineering, with pluralized management." There has been considerable progress in both the design and research work in ship and ocean engineering, and with pluralized management. In less than two years, the Institute has concluded 530 multiple-management contracts and technological agreements. The technological missions and contracts have extended to construction ashore, swimming facilities, physical training facilities, foodstuff machinery, industrial micromachinery, mounted pendants and their backing, park facilities, etc. Based upon market intelligence, development has also started on such new and in-demand consumer products as a mineral water plant, portable sanitary toilets, all-purpose control microcputers, etc.

In the tide of reform, Research Institute 708 has been unceasing in its forward development. We fervently hope that in the future they will make new and even greater contributions to their country's ship and ocean engineering!

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CSO: 4008/64

RESEARCH INSTITUTES BECOME SELF-SUPPORTING BUSINESS

Beijing GUANGMING RIBAO in Chinese 12 Mar 87 p 1

[Text] The change of the Nanchang Municipal Scientific Research Institute, in Jiangxi, into an industrial-technological development center, has aroused the enthusiasm of the scientific research personnel, narrowed the gap between research and business, contributed to Nanchang's industrial development, and produced rather good economic and social results. The various units under the center are making enough money to pay their employees' wages and welfare bills, saving the government 300,000 yuan in operating expenses in the past 2 years.

The Nanchang Municipal Scientific Research Institute was a local research unit. Most of its research projects were assigned by the state, and research results were often shelved as samples and display items. To change the phenomenon of scientific research divorced from production and narrow the gap between research and business, the municipal CPC committee and the municipal government decided in early 1984 to turn this comprehensive research institute and the Nanchang Municipal Mechanical Research Insitute into the Nanchang Municipal Industrial-Technological Development Center to directly serve the city's industrial production. The center consists of eight research institutes in such fields as energy conservation, microcomputers, food, musical electronics, and so forth. In 1985, all the institutes began operating on a contract basis and assumed responsibility to meet their own wage and welfare expenses. The contract responsibility system aroused the scientific research personnel's enthusiasm. They left their offices and cycled to factories, workshops, and suburban township enterprises to find out what kinds of research were urgently needed in production. In 1985, they provided technological services and carried out research work for 56 enterpises, enabling the enterprises to increase their output value by 3.58 million yuan. In 1986, they undertook 54 development and research projects, 30 of which were completed by the end of the year, including 7 which met advanced national standards. A computerized boiler control console developed by the microcomputer institute showed marked energy-saving results and has been included by the provincial economic commission in a major technological transformation project in the Seventh 5-Year Plan. A computerized traffic control signal system developed by the institute can regulate the timing of traffic movements whenever necessary to reduce traffic jams and save fuel. It is being installed at intersections in Nanchang city. It is estimated that the popularization of these research results will produce more than 40 million yuan in economic benefits.

The center's policy of conducting research, pilot-scale production, and technological dealings in a separate but well-coordinated manner has greatly enhanced its capacity for independent development. In 1986, the center's various units, using their own equipment and technological resources to undertake pilot-scale experiments, develop new technologies, and contract for technical cooperation and processing work, not only accelerated the pace at which research results were put to practical use, but made a profit of 30,000 yuan out of a total output value of 229,000 yuan. In the past 2 years, the center has set up a scientific and technological service company and a Nanchang computer company, which market technologies as commodities. The computer company started with a loan of 50,000 yuan. In 1986, it did 1.67 million yuan worth of business and turned over to the state 110,000 yuan in taxes and profit, contributing to the national economy while accumulating funds for its own independent development. It also spent 5,000 yuan to train more than 270 computer maintenance and operating personnel and repair more than 100 computers for various places.

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CSO: 4008/2100

YANGQUAN TECHNOLOGICAL INSTITUTE INTRODUCED CONTRACT SYSTEM

Beijing GUANGMING RIBAO in Chinese 13 Mar 87 p 1

[Text] At the recently held Shanxi provincial S&T work conference, the delegates were impressed by a multileveled internal and external contract system introduced by the Yangquan Technological Research Institute.

The institute's contract system consists of four parts: 1. At the beginning of each year, the institute signs a contract with the municipal S&T commission, undertaking to start 5 new research projects, complete appraisal of two research results, and earn 40,000 yuan in the year. The S&T commission guarantees the institute's director and party committee secretary, who are appointed by higher authorities, all decisions on organizational matters, personnel arrangements, research project selection, transfer of technological achievements, and rewards and punishments will be made by the institute. 2. Each section or office signs a contract with the institute, specifying the quantity of research work and the amount of net income it must deliver. The institute guarantees that 8 percent of the income from projects included in the plan and 70 percent of the income from projects not included in the plan will be retained by the section or office for distribution as it sees fit. 3. The sections and offices and technical services and technology transfers. Their external contracts are guaranteed by the institute. 4. To bring the role of retired scientists into full play, the institute helps them secure technical service contracts and acts as their guarantors.

Last Year, a chemical engineering group formed by Tian Feng and two other engineers completed the research project they contracted for, a "new alumina processing technology," ahead of schedule, for which they should receive more than 500 yuan according to their contract. Then, they voluntarily went to a poor mountain village where conditions were hard and helped the peasants develop a "new light calcium extraction technology." As a result, the village-run light calcium plant, which could not operate on a regular basis before, are now turning out first-class products of export quality. At year's end, the institute, acting according to contract, paid the group more than 5,400 yuan as remuneration for personal services. Wang Yumin is a retired technician. When working in the institute, she developed a specific agricultural chemical for the prevention and control of an apple rot disease. Acting on the provision that scientists and technicians may join enterprises by

contributing shares in the form of technologies, the institute took the initiative in helping her sign a contract with a township enterprise and serve as plant manager for production of the agricultural chemical. The chemical is highly effective in curing the disease known as the "cancer" of apples with a cure rate of more than 97 percent. Since the introduction of this new product last year, the plant has made a profit of 290,000 yuan in 1 year. Based on her contract, which is guaranteed by the institute, Wang Yumin received the remuneration she is entitled to from the plant. The well-thought-of contract system serves as a strict and fair basis for rewards and punishments. It is known as the institute's "constitution." After contracts are signed, they are sent by the institute to the finance, tax, and notarial departments for stamping and approval. Last year, the scientists and technicians received the payments due them in full from their internal and external contracts.

Implementation of the contract system has not only protected the interests of the scientists and technicians, but aroused their enthusiasm. In the past, they had to sell their services on the sly. Now, they can contract for external work with the institute as their guarantor. After completing the projects included in the institute's plan, the scientists and technicians now voluntarily look for more service or research projects to boost their income. In the past year, the institute with a staff of only 37 opened up 26 research projects and successfully completed 7 of them. Among the results, a methane siren and a nondestructive hardness tester have been appraised by the relevant ministry as meeting advanced domestic and international standards for similar products. In addition to earning 40,000 yuan, as stipulated in its contract with the municipal S&T commission, the institute made another 120,000 yuan. The income of scientists and technicians also increased sharply. In addition to their wages, each person made an average of 800 yuan in extra income last year.

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CSO: 4008/2100

SPACE RESEARCH INSTITUTE MAKE GOOD USE OF PERSONNEL

Tianjin JISHU SHICHANG BAO in Chinese 18 Mar 87 p 1

[Excerpts] Scientists and technicians of the Ministry of Astronautics Industry [MAI] 210 Research Institute are actively encouraged to go out of the institute to develop lateral relations and put their knowledge to good use. In the past 3 years, they have developed 19 new products, transferred 13 new technologies, completed research and development projects for more than 60 units, provided technical services to more than 100 units and factories in 15 provinces, municipalities, and autonomous regions, and signed 132 external research and development contracts and agreements. In Xi'an City alone, they have established long-term technical-cooperation ties with more than 30 factories and helped the local enterprises increase their profits by more than 10 million yuan. The average income of the institute's own personnel has more than doubled. In 1986, the Shaanxi provincial government conferred the title of "advanced unit in transferring technology for civilian use while insuring fulfillment of defense tasks" on the institute. The MAI issued a citation to the institute.

The 210 Research Institute has nearly 1,000 engineers, and is fully equipped in various specialized fields. The leadership actively encourages the scientific and technical personnel to hold other jobs in their sparetime and do research in factories. At present, more than 20 percent of the institute's scientific and technical personnel hold other jobs and are engaged in joint research projects with economic departments. Economic and technological results from lateral relations established by institute offices and personnel are publicly commended by the institute from time to time.

The institute developed a microcomputer control system for the alcohol distillation process for the Guozhen alcohol plant in Baoji. As a result, the plant's annual net profit has increased by more than 1.2 million yuan. The dry-chemical fire extinguisher the institute transferred to a Guangdong factory is the first of its kind developed in China. With the new product, the factory increased its output value by more than 500,000 yuan and profit by more than 100,000 yuan in the same year. A cement charge mixture control system developed for the Yanta cement plant in Xi'an has greatly improved cement quality and increased the plant's annual profit by 400,000 yuan. In the past few years, the institute has helped various factories install production lines for automatic automobile assembly, automatic meat processing or canning, steel casting, polar plate rolling, fruit and vegetable dehydration, color television switches, Maotai liquor bottling, automatic microcomputer-controlled beer processing, and so forth. The institute's technical personnel are found everywhere in the country.

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